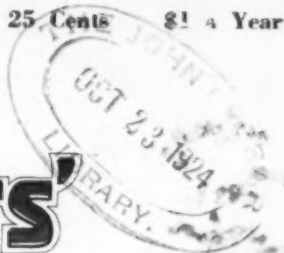


OCTOBER, 1924

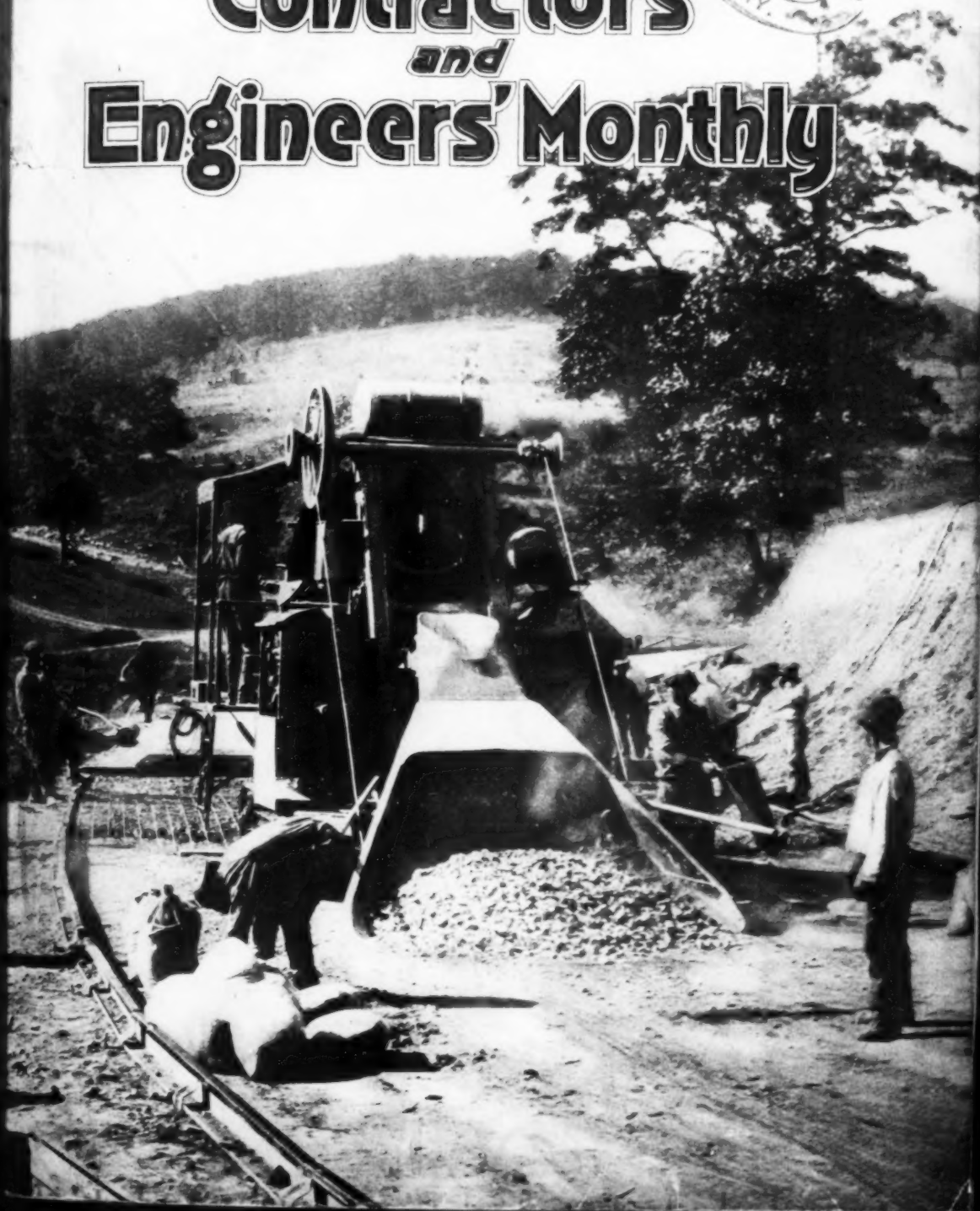
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Contractors' *and* Engineers' Monthly





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WIRE MESH AND
CONTRACTION JOINTS

VOL. IX. No. 4

CONTRACTORS' & ENGINEERS' MONTHLY

OCTOBER, 1924

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Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment.



The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the **CONTRACTORS' & ENGINEERS' MONTHLY**. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

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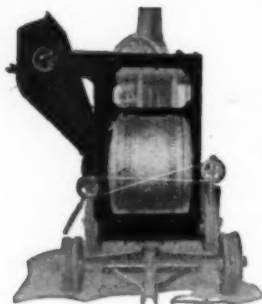
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Heavy Duty Mixer



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10, 14, 21, 28 cu. ft.
Mixed Concrete.

Steam, gasoline or electric power. Mounted on trucks or skids. Rubber tired wheels optional.

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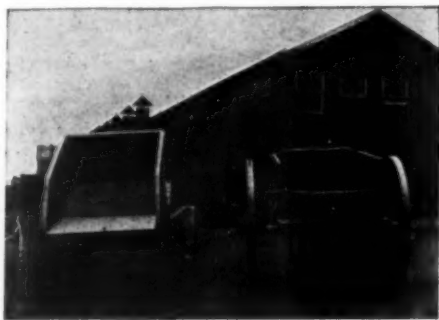
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"GET" THESE EASTON RAPIDUMP FEATURES

"Get" how the body is released by the seated driver—automatically rolls over—throws out the load—and returns to an automatically locked position while the truck is pulling away.

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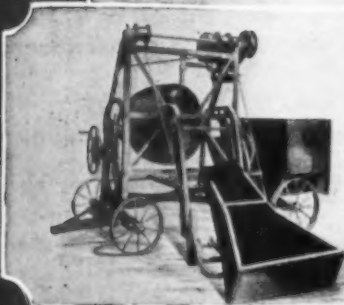
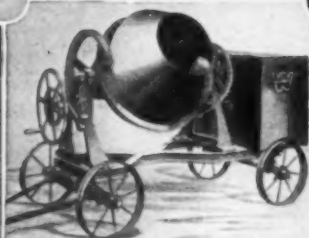
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Construction Machinery Co.

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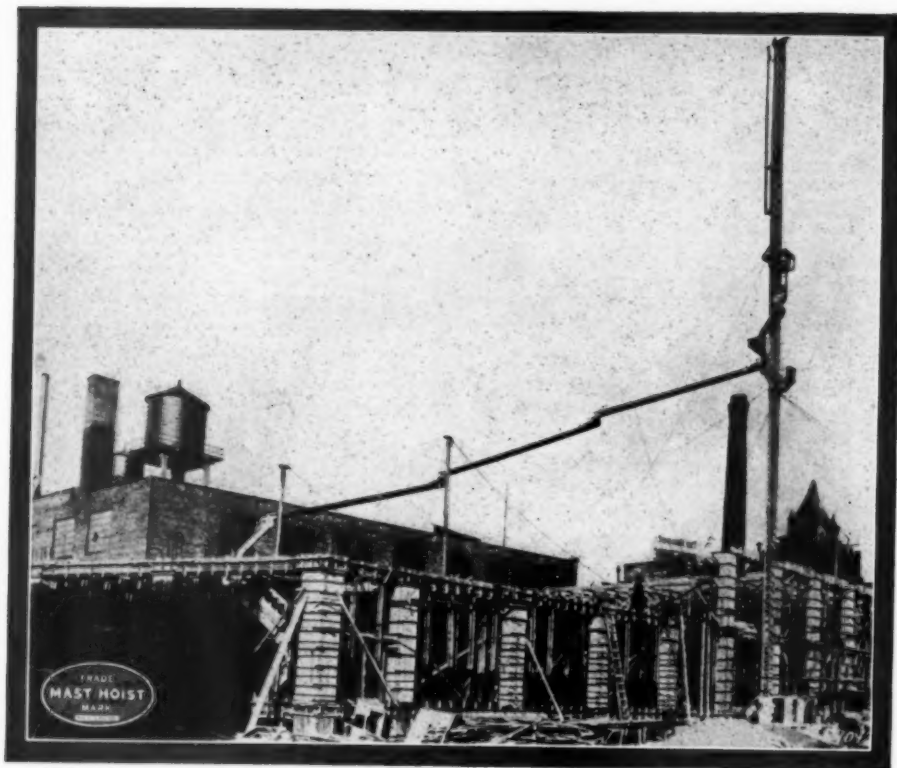
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For a 7-S or 14-S Mixer

THE Insley Steel Mast Boom Plant is designed for use on concrete work in which the yardage is insufficient to warrant a steel tower installation, but large enough so that chutes can be used advantageously. In general, jobs having between two hundred and three thousand yards fall in this class.

The Steel Mast Plant is made with two bucket sizes, to take the output of a 7-S or 14-S mixer. With the smaller size the day's output will be fifty to eighty yards. With the larger size it will be about a hundred and eighty yards a day. Either size will take care of all the output of a corresponding size mixer.

The smaller bucket can be had for either a wood or steel mast. When the wood

mast is used, it is built by the user. This same bucket can later be put on a steel mast, if desired. The larger bucket can be used only on a steel mast.

The Steel Mast is designed for a maximum height of 140 feet, and is made in twenty-foot interchangeable sections. It is rigid enough so that the first thirty-foot section of chute can be tied back to it, eliminating an otherwise necessary chute support, giving in effect a free pouring radius of sixty feet. A sliding frame is provided which makes it possible to move the chute assembly to any desired level on the face of the mast.

A Material Elevator platform, which is interchangeable with the bucket, increases the usefulness of this plant.

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Flood control on Firey Ave., LaVerne, Calif. Height of curb, 4 ft. Length, 1 1/4 miles. 3/4 inch Elastite Expansion Joint every 25 ft. in curb and gutter. Built 1921 by E. L. Garrison.



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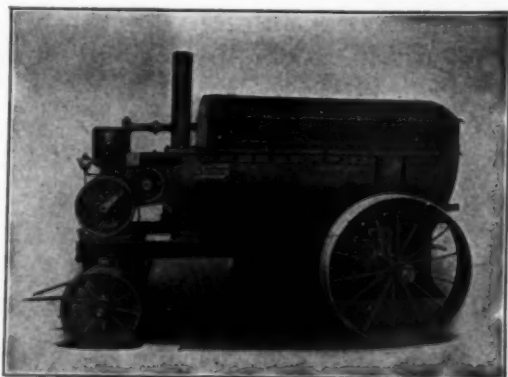


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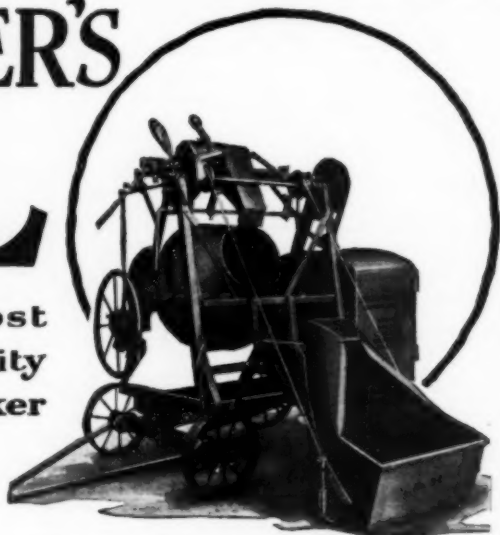
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 Ersted Machinery Mfg. Co., Portland, Oregon.
 Oklahoma Eng. & Fdry. Co., Muskogee, Okla.
 Otis Engine Corp., New York
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 Whitehead & Kales Co., Detroit, Mich.

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 *Russell Grader Mfg. Co., Minneapolis, Minn.

Adams, J. D. & Co., Indianapolis, Ind.
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 Haddfield-Penfield Steel Co., Bucyrus, Ohio.
 Wehr Co., Milwaukee, Wis.

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 Gallion Iron Works & Mfg. Co., Gallion, Ohio

FORDSON SAW SIGS

Buddie Equipment Co., Cleveland, Ohio.

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 Miami Trailer Co., Troy, Ohio.
 Mishin Scraper Works, Ucon, Idaho.
 Gustav Schaefer Wagon Co., Cleveland, O.

FORDSON TRACTION TREADS

Full-Crawler Co., Milwaukee, Wis.
 A. C. Johnson Products, Racine, Wis.

FORDSON TRACTOR TRUCKS

Toppins Tractor Truck Co., Appleton, Wis.

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 Trail-Ford Corp., Ann Arbor, Mich.
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 Troy Trailer & Wagon Co., Troy, O.
 Whitehead & Kales Co., Detroit, Mich.

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 *Connelly & Co., Philadelphia, Pa.
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 Heltsel Steel Form & Iron Co., The Warren, O.
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 Lakewood Eng. Co., Cleveland, Ohio.
 Metal Forms Corp., Milwaukee, Wis.

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 Crane Co., Chicago, Ill.
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 Puro San. Dr. Ftn. Co., Haydenville, Mass.
 Rundle-Spence Mfg. Co., Milwaukee, Wis.
 Stewart Iron Works Co., Cincinnati, O.
 Taylor Co., Halsey W., Warren, O.
 Twentieth Century Brass Wks., Belleville, Ill.

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Art Metal Constn. Co., Jamestown, N. Y.
 General Fireproofing Co., Youngstown, O.
 Van Dorn Iron Works Co., Cleveland, O.

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GARBAGE DISPOSAL

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Tiffin Wagon Co., Tiffin, O.
Watson Products Corp., Canastota, N. Y.

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Byers Machine Co., Ravenna, Ohio.
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Graver Corp., East Chicago, Ind.
Seafie & Sons, Wm. B., Oakmont, Pa.
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Wayne Tank & Pump Co., Ft. Wayne, Ind.

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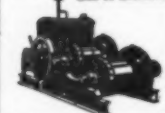
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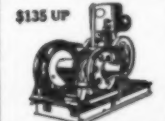
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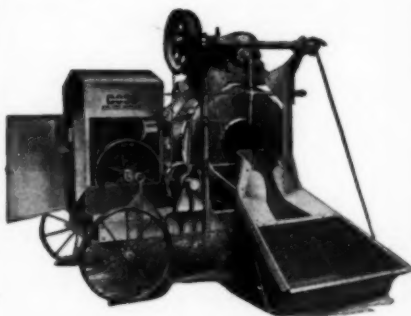
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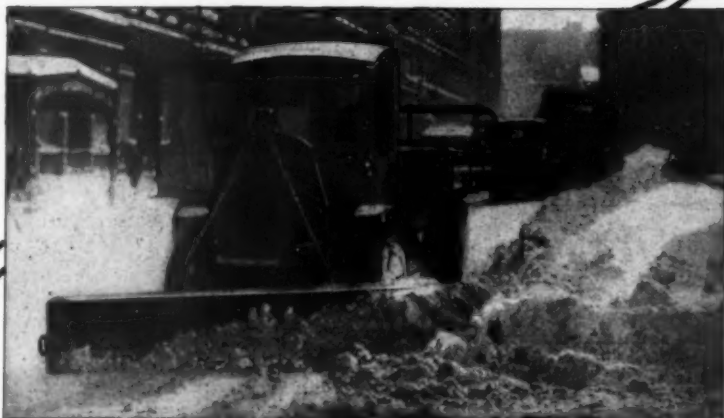
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- *Universal Road Machinery Co., Kingston, N. Y.
- Austin Machinery Corp'n, Muskegon, Mich.
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- Fate-Roth-Heath Co., Plymouth, O.
- Lima Locomotive Wks., Lima, O.
- Industrial Equipment Co., Inc., Minster, O.
- Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
- Porter Co., H. K., Pittsburgh, Pa.
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- *Neptune Meter Co., New York.
- *Pittsburgh Meter Co., Pittsburgh, Pa.
- Mueller Co., Decatur, Ill.
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- Builders Iron Fdry., Providence, R. I.
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- *Neptune Meter Co., New York.
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- Buffalo Meter Co., Buffalo, N. Y.
- Federal Meter Co., Brooklyn, N. Y.
- Gamon Meter Co., Newark, N. J.
- Horsey Mfg. Co., Boston, Mass.
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- Thomson Meter Co., Brooklyn, N. Y.
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Most of the winter and spring damage to roads is due either to poor drainage or poor surfacing. In either instance the damage is done by the water which penetrates into the road and freezes. When the spring thaws come, particularly when freezing and thawing alternate several times, the wheels of traffic soon cut deep into the road and it becomes impassable, or nearly so.

It is safe to say that for every dollar spent now in the needed protection of a road, you are eliminating the necessity of spending two dollars in the spring or summer—and you'll have good roads in spring when you need them.

Any defect which may exist in your asphalt roads should be corrected now, and macadam, gravel and dirt roads should be protected now by applying the proper grade of

Standard Asphalt Road Oil

These oils, properly applied, will form a protective covering which will do much to keep them good throughout the year, particularly through the spring, when so many unprotected roads become impassable. Remember, please, that the recommendations and advice of the engineers in our asphalt department are always available. They will be glad to co-operate with you on any road problems—and their years of study and practical experience make their suggestions well worth while.

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Write, wire or phone us today.*



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NOW is the time to get busy on road repairs. Don't wait for winter snows and heavy frosts to attack weak spots. Get after the bumps, holes and hollows. Make sure that your roads will be in good shape to withstand spring thaws and traffic.

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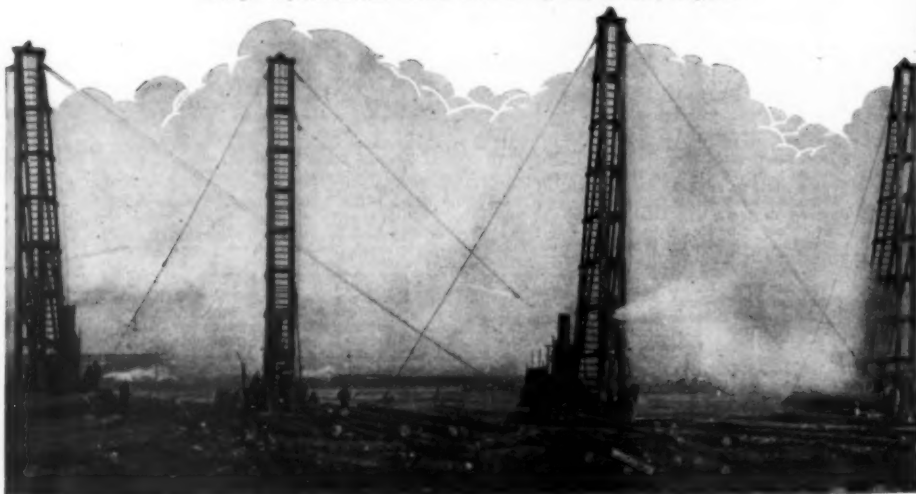
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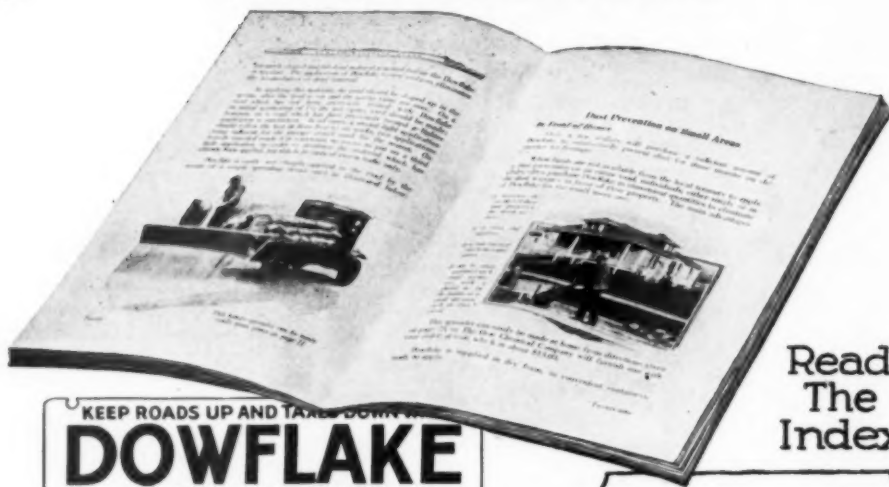
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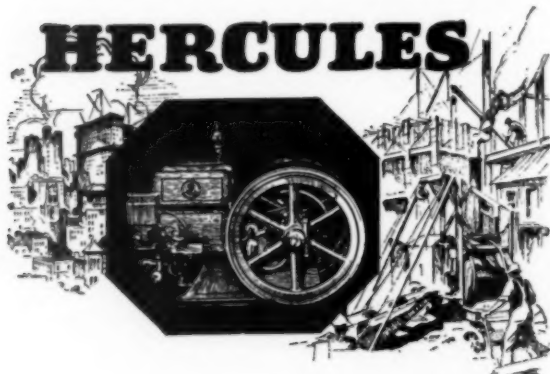
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- Bucyrus Co., South Milwaukee, Wis.
- Byers Machine Co., J. F., Ravenna, Ohio.
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- Nelke Sign Co., J. L., New York.
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- Union Iron Products Co., East Chicago, Ind.
- Western Display & Mfg. Co., St. Paul, Minn.

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- Line Material Co., So. Milwaukee, Wis.
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- Smith Mfg. Co., A. P., East Orange, N. J.

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SMOKE STACKS. (See Stacks, Steel)

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- Field Force Pump Co., Elmira, N. Y.
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- Pacific Tank & Pipe Co., San Francisco, Cal.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- United Iron Works, Inc., Kansas City, Mo.
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STEAM SHOVELS. (See Shovels, Steam)

STEAM TURBINES. (See Turbines.)

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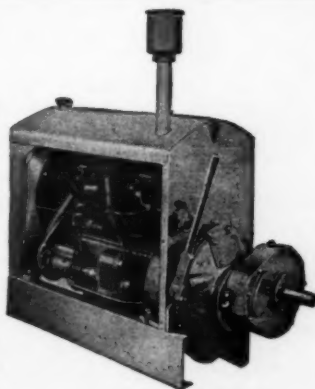
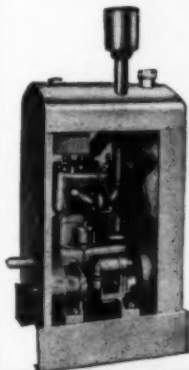
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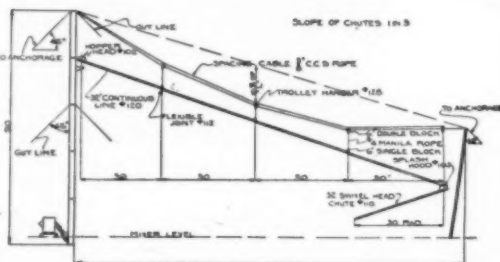
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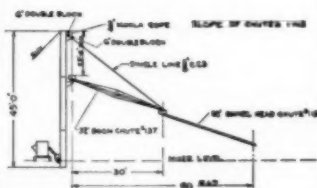
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Contract Cost Keeping and Cost Codes for Distribution of Costs

A Complete Manual Prepared and Issued by the Contractors' Association of Northern California

Cost Keeping in General

COST keeping for the contractor is designed to classify the expenditures of a job into the natural divisions or units of the work and to segregate the costs of the different units. Cost keeping should begin with the preparation of the bid estimate and should be carried continuously, simply and accurately, until final completion of the work.

The cost of every unit of product is composed of four basic elements of expense—labor, materials, plant and equipment, and general expense, or overhead. These elements are defined hereinafter.

Labor is divided into two classes of costs—direct and indirect. For example, labor on a mixer is a direct charge, while the time of the field superintendent directing all of the work is an indirect labor charge and must be prorated daily to the several classes of labor.

Materials are divided into two classes of costs—direct and indirect. All materials incorporated into the product are direct, and those used indirectly to produce the product are indirect. Cement and stone are direct costs, while the steel headers are indirect costs. It requires care to charge indirect material costs to the proper unit of product, especially fuels, oils, greases and similar items.

General expense or overhead includes all charges that cannot be connected directly with the cost of labor, mate-

rials or plant. All charges which cannot be properly entered against each definite unit of the work should be made under this heading.

Plant and equipment includes all land, shops, structures, machinery, live stock, and heavy tools used on the work. The cost of all service of plant and equipment can be charged most readily in the form of a daily rental. Many contractors include the fixed charges only, in the determination of rentals to be applied on the job, and use both fixed and operating charges in building up estimates. This rental should consist of the following fixed and operating charges:

Operating Charges

1. The expense of operation
2. The average cost of repairs

Fixed Charges

3. Charges for depreciation
4. Interest
5. Taxes
6. Insurance

Rentals—How Determined

It is impossible to determine exactly the rental which should be charged to a piece of equipment on the work, but by careful analysis the rental value should be determined within certain practical limits. Interest, taxes and insurance are fixed charges, but depreciation depends upon the original cost, useful life and salvage value. Maintenance will not offset depreciation and after a period of time the machine will have a scrap value only. Contractors' equipment should be used only as

Cost Keeping Is Not Bookkeeping

In studying this system of cost keeping it must be kept in mind that cost keeping is not bookkeeping. Labor, both direct and indirect, is charged daily, and all materials, supplies and minor maintenance should be charged in the same manner. Equipment, plants and power units should be charged daily as rentals, and all other fixed and general charges should be charged to the daily reports or to the periodical reports in a similar manner, that is, by prorating the expense over the work by days or by units. The general expense as calculated in preparing the estimates can be prorated over the number of square yards, cubic yards, tons, or other units used in measurement.

The cost keeper is not interested in the purchasing of a large amount of lumber to be used on the job for general purposes, he is only interested in charging this material out as it is used. If these facts can be firmly fixed in the mind, cost keeping will be easy to understand.

long as it is efficient; therefore, the best method to determine depreciation is to deduct an estimated salvage value from the original cost, and prorate the difference over the probable life of the equipment. The depreciation rate thus obtained can then be applied as a fixed charge. The average cost of repairs can be determined from past performance only.

With the exception of favored localities, the average working period for the general contractor is less than eight months out of the year, and in many districts certain plants will operate less than six months. The general contractor, knowing his climatic and other conditions, should be able to estimate closely the time his equipment will be in service and, therefore, in estimating rentals will take care of the fixed charges for the year by prorating them over the estimated time of service. This fixed charge added to the cost of operation and to the average cost of repairs will fix the daily rentals to be charged to the job, or to be used in preparing estimates.

Estimates should be compiled systematically and carefully and in such manner that they can be readily compared with the segregated costs kept on the job. For example, an estimate is to be prepared for setting up a temporary plant to crush stone. In compiling the estimate all fixed costs should be assembled, to which will be added the operating, freight, labor and material costs of the "set-up," and for dismantling and returning. When the plant costs have been compiled, the total will be divided by the number of cubic yards to be crushed to obtain the plant costs per cubic yard of stone. The estimator will also have considered the output per day and the probable time the plant would be in service. From the assembled data it is easy to compute a rental charge per day, or per square yard, to be used in the bid estimate for surfacing.

Duties of Cost Keeper

On ordinary construction jobs the work of cost keeping is assigned to the timekeeper. He is a very busy employee, often acting as purchasing agent and material man. It would be well to curtail his duties to that of time keeping and the daily preparation of the cost distribution and summary. In order to facilitate and simplify his work and to promote accuracy, his instructions and his work should be made as definite as possible. Accuracy should be required at all times; this point cannot be too strongly emphasized.

It may be economical in some cases to have foremen keep the time books as well as the daily cost record sheets, and for this reason some objection has been raised to the use of code numbers. Should any difficulty be experienced in training the (old-time) foreman, he can be instructed to write in the operation, which can then be translated into code by the timekeeper or other official in responsible charge of cost keeping.

Classification of Expenditures

The selection of items on which to collect costs requires care and some little ingenuity. No more items should be used than necessary to produce a clear analysis of the different operations. For example, a contract calls for crushed stone in the bunkers to be measured by the cubic yard. In the final analysis the cost per cubic yard delivered in the bunkers is the important item, but in arriving

at that cost several operations must be considered, the most important of which are: (1) stripping, (2) drilling, (3) shooting, (4) bull-dozing, (5) loading, (6) hauling, (7) crushing and screening.

Of the above operations, stripping will probably be carried as a separate operation; that is, it will be finished before the drilling is commenced. Bull-dozing, for simplicity, may be carried as a part of the cost of labor, or of drilling and shooting. Drilling and shooting will be carried as a single operation. This will leave four cost operations for the timekeeper to segregate daily, that is, (1) drilling and shooting, (2) loading, (3) hauling, (4) crushing and screening. To facilitate keeping the daily costs for these operations, the crushing plant should be carried on a daily rental basis and recorded on the "Daily Time and Cost Record." All materials and supplies should be recorded on the "Material and Supplies" form. To determine the drilling costs, the number of feet of holes drilled per day should be recorded. When all of the daily costs have been assembled, the yardage through the crusher will determine the cost per cubic yard.

Checking Quantities

In analyzing a daily summary of the several features on a job it is often difficult to arrive at the quantity of work which has been accomplished. It will be found a simple matter to obtain a cost segregation of the labor, equipment, etc., but although the cost items may be obtained for a section of grading, the daily summary is of little value unless the number of yards moved is known. There is a great temptation on the part of foremen to exaggerate quantities, and the cost keeper should check the yardage against the profile quantities as furnished by the engineer, and compare it with the foreman's estimate. These quantities should again be checked in the weekly and monthly analysis against the profile quantities. A heavy cut may not be completed in a day, but in a week or more a certain section will be finished and the cubic-yard cost will be accurately obtained.

The quantities of sand, gravel, crushed stone, etc., can be determined more accurately by estimating them in place than by measuring them in the truck or in stock piles. The cost keeper's work can be reduced considerably by charging quantities as they are mixed and placed, especially in concrete pavements. The record of loading and hauling should be kept by truck measurement and checked against the estimated quantities contained in the pavement yardage. The check is simplified by noting on the material sheets the quantities delivered between stations or over a given section. There will always be a certain wastage, but this should be allowed in the bid estimates.

Efficiency of System

A cost-keeping system to be effective must enable the officials responsible for the work to discover incompetency or inefficient methods in time to be of use. For this purpose a daily report should be prepared by the cost keeper or superintendent, which will later be consolidated into weekly and monthly reports.

Special Forms

All large plants, such as asphalt plants, should be carried on a special form designed to cover cost of operation and supplies. Rollers, crushers,

mixers and other equipment will appear on the daily record as a rental charge, or at the actual cost of operation as shown on the daily records plus fixed charges. Equipment units should be given a field number to facilitate recording the costs.

All replacement parts and major maintenance costs should be carried in a general equipment account. It is impossible to prorate costs of this nature accurately while on the job. The equipment account should show the nature of the charges against each plant or piece of equipment, which will provide the data necessary for computing rentals. An equipment account will also facilitate the computing of depreciation to be shown against equipment in preparing income tax returns. Minor maintenance should be carried as an indirect charge on the job. Minor maintenance includes labor and supplies for blacksmithing and other similar items.

Contract Cost Keeping and Cost Codes for Distribution of Costs

There are two common methods used in recording costs. The first and most used by contractors is that of recording classes of work and operations by writing in the names of the class and of the operation. The second method is that of recording both classes and operations by the use of symbols—either letters or numbers or a combination of both. The written method requires much additional work on the part of the cost keeper and is not easily standardized in printed form. The second method has the advantage of flexibility and insures uniform segregation throughout.

The cost-keeping codes are designed for the use of the contractor doing general road work, dam construction, railroad grading, tunnel and track work. The same methods can be followed in designing codes for any other class of construction. The units conforming in general to the usual bid units, are designated by name and are assigned ten numbers each, each number representing a class or part of the work. The cost keeper in preparing his code can add more classes or make such changes as are necessary to conform to the requirements of the work. The principal units of construction are enumerated herein, and the accompanying codes give a development of the cost-keeping system:

Bid Units and Class Code

Clearing and Grubbing	
00	Right of way
01	Trees and Brush
02	Stumps and Roots
03	Boulders
09	Miscellaneous
Grading	
10	Road-Bed
11	Cuts
12	Embankments
13	Shoulders
14	Berms and Slopes
15	Ditches
16	Borrow-Pits
19	Miscellaneous
Tunneling	
20	Tunnel
21	Concrete Lining
22	Portals
23	Timber Lining
24	Forms
25	Tracks
26	Lagging
27	Sets
28	Muck
29	Miscellaneous
Ditching, Draining and Culvert Installation	
30	Ditches
31	Drains

32	Tile
33	Pipe
34	Catch-Basins
35	Channels
36	Head-Walls
39	Miscellaneous
Bridge and Trestle Construction	
40	Bridge, Trestle
41	Superstructure
42	Foundations
43	Piers
44	False Work
45	Abutments
46	Piling
47	Forms
48	Steel
49	Miscellaneous
Macadamizing, Graveling	
50	Road-Bed
51	Ditches
52	Screenings
53	Headers
54	Subgrade
55	Filler
56	Base Course
57	Top Course
58	Shoulders
59	Miscellaneous
Paving	
60	Road-Bed
61	Concrete or Asphalt Pavement
62	Subgrade
63	Headers
64	Steel or Mesh
65	Base Course
66	Top Course
67	Aggregates
68	Shoulders
69	Miscellaneous
Track Laying	
70	Road-Bed
71	Ties
72	Switches
73	Steel
74	Ballast
75	Berms
76	Plates
77	Spikes
79	Miscellaneous
Quarrying—Gravel Production	
80	Quarry
81	Stone or Gravel
82	Gravel-Pit
83	Overburden
84	Drill Holes
85	Tunnels
86	Waste
87	Track
89	Miscellaneous
Dam Construction	
90	Cuts and Embankments
91	Foundation
92	Grout Holes
93	Pressure Grout
94	Drainage Wells
95	Structural Steel
96	Reinforcing Steel
97	Valves and Gates
98	Pipes
99	Miscellaneous

General Expense, Plant and Equipment Code

Camp or Corral Construction	
100	Tents
101	Houses
102	Plumbing and Fixtures
103	Fences
104	Ditches and Drains
105	Equipment, General
106	Septic Tank
107	Roads and Trails
109	Miscellaneous
Plant Construction	
110	Buildings
111	Bunkers
112	Roads and Trails
113	Tracks
114	Tanks
115	Machinery
116	Equipment
119	Miscellaneous
General Expense or Overhead	
120	General Office Maintenance

121	Legal
122	Clerical
123	Expense of Estimating and Bidding
124	Telephone and Telegraph
125	Auditing
126	Transportation
129	Miscellaneous
Plant and	Equipment
130	Grounds and Buildings
131	Material Yards
132	Shops
133	Camp Equipment
134	Live Stock and Equipment
135	Trucks and Automobiles
136	Power Units
137	Power Equipment
138	Storage and Transportation
139	Miscellaneous
Supplementary	Units
140	Curbs
141	Monuments
142	Sign Posts
143	Retaining Walls
144	Riprap
145	Guard-Rails
146	Fences
149	Miscellaneous

Prefixes

The class code for camp or corral construction and plant construction can be expanded in the same manner as for other construction features. When corrals and camps are under construction simultaneously, a prefix letter can be used to distinguish between them. For example, the code for tents for corrals is 100, while tents for camp is A-100. Prefix symbols should be used only upon authority of the head office, as it may be necessary to use prefix letters occasionally on other classes of construction.

Operation Code

The operation code includes all those operations performed in constructing the different parts of the work appearing in the class code and can be extended or developed to conform to a class code for other work not considered herein. The code for recording any unit of work is obtained by joining a number from the class code to a number from the operation code. For example, the timekeeper in recording the time for Frank Smith, who is finishing concrete, finds that the class code for pavement, concrete, is 61, and that the operation number for finishing is 37; the finisher will therefore be recorded under the code 61-37:

- 00	Assembling
- 01	Backfilling
- 02	Blacksmithing
- 03	Blading
- 04	Blasting
- 05	Building
- 06	Building Forms
- 07	Building False Work
- 08	Bulldozing
- 09	Burning
- 10	Boring
- 11	Burring
- 12	Cleaning
- 13	Clearing
- 14	Clearing and Grubbing
- 15	Coating
- 16	Cofferdamming
- 17	Covering
- 18	Cribbing
- 19	Curing Concrete
- 20	Cutting
- 21	Crushing
- 22	Dragging
- 23	Drilling
- 24	Drilling and Blasting
- 25	Erecting Steel
- 26	Excavating Borrow
- 27	Excavating Common
- 28	Excavating Earth
- 29	Excavating Loose Rock
- 30	Excavating Solid Rock
- 31	Excavating Wet Earth
- 32	Facing

- 33	Fencing
- 34	Filling Ruts
- 35	Filling Washouts
- 36	Fine Grading
- 37	Finishing
- 38	Forming
- 39	General
- 40	Grouting
- 41	Grubbing
- 42	Guarding
- 43	Harrowing
- 44	Hauling
- 45	Heating Bituminous Materials
- 46	Heating Materials
- 47	Hoisting
- 48	Laying
- 49	Leveling
- 50	Loading
- 51	Loading and Hauling
- 52	Loosening
- 53	Maintaining
- 54	Mixing
- 55	Mixing and Placing
- 56	Moving
- 57	Operating
- 58	Oiling
- 59	Painting
- 60	Patrolling
- 61	Paving
- 62	Pile Driving
- 63	Placing Materials
- 64	Placing Steel
- 65	Planting
- 66	Plumbing
- 67	Plowing
- 68	Pumping
- 69	Quarrying
- 70	Removing Snow
- 71	Repairing
- 72	Riveting Steel
- 73	Rolling
- 74	Scarifying
- 75	Screening
- 76	Setting
- 77	Shaping
- 78	Shifting
- 79	Spreading Bituminous Materials
- 80	Spreading Materials
- 81	Spreading Screening, Sand or Chips
- 82	Sprinkling
- 83	Stripping
- 84	Tamping
- 85	Timbering
- 86	Trimming
- 87	Washing
- 88	Washing and Screening
- 89	Wasting Materials
- 90	Waterproofing
- 91	Working on Joints
- 92	Wrecking

Timekeeper's Code

After a tentative program of the work has been outlined, a code should be prepared for the use of the timekeeper covering all features of the work under immediate construction. The code used will depend upon the segregation desired. The following examples give both abbreviated and expanded codes.

It will be noted that "Paving" covers all types, as it is unlikely that more than one type will be included in the same job. The class code for pavement includes the numbers from 60 to 69, and it should be remembered that when any of these numbers are recorded it includes some class or part of the pavement of the type under construction. For example, when the code 62-37 is recorded in the "Daily Time and Cost Record" it is a simple method of expressing "Pavement, Concrete, Subgrade, Finishing," or, "Pavement, Asphalt, Subgrade, Finishing."

Code for Concrete Pavement

Abbreviated
61-55 Concrete Pavement—Mixing and Placing
Expanded
65- SUBGRADE
61-77 Shaping
61-82 Sprinkling

of men or equipment or both. This form records the time and cost segregation of the foreman and his gang. Twelve laborers were employed, numbered from 1 to 12; Hoist No. 1; Engineer No. 1; Water Boy No. 1; Truck No. 3; Driver No. 3. They were employed in loading and hauling heavy piling for bridge work. The record shows that at 10 A. M. numbers 1 and 5 were transferred to repairing road-bed, and numbers 6 and 7 were transferred to excavating a ditch. At noon all equipment and part of the men were laid off and the foreman and six men were employed during

Cement is charged to 61-55 Concrete, Mixing and Placing
Stakes are charged to 63-76 Headers, Setting
Stone is charged to 61-55 Concrete, Mixing and Placing
Sand is charged to 61-55 Concrete, Mixing and Placing
Gasoline is charged to 61-55 Concrete, Mixing and Placing
Oil is charged to 61-55 Concrete, Mixing and Placing
Nails are charged to 63-76 Headers, Setting

GOLDEN STATE CONSTRUCTION CO.										
PERIODICAL REPORT										
CONTRACT <u>24-2</u> STA. <u>1</u> TO STA. <u>639</u>										
WORK BEGUN <u>July 1</u> REPORT TO <u>July 7</u> SIGNED <u>4-23-6</u> Supt.										
CODE	LABOR		EQUIPMENT		MATS & SUPPLIES		TOTAL TO DATE	UNITS COMPLETED TO DATE	UNIT COST	REMARKS
	KIND	AMT	KIND	AMT	KIND	AMT				
61-55	Labor	280	Truck	25	Cement	3365				
	Eng'r's	40	Mixer	35	Sand	1415				
	Finisher's	50			Stone	745				
	Indirect	58			Gas	66		50 1/2		
					Oil	18	6097	3460	1762	
67-51	Drivers	168	Trucks	720	Gas	99				
	Indirect	26			Oil	21	1040		0 301	
63-76	Labor	60			Stakes	37				
	Indirect	9			Nails	4	111		0 032	Stakes run 3/4" 1/40 to 6 hours 3/4" 1/30 (all time 18 ft wide)
62-73	Eng'r's	40	Rollers	25						
	Labor	60								
	Indirect	15					1467	0 141		
								Total	2 136	

FORM FOR THE PERIODICAL REPORT, DESIGNED TO ASSEMBLE THE TOTAL OF THE DAILY REPORT (FORM 4)

the afternoon on shaping subgrade and setting headers.

The code used is as follows:

- 46-51 Bridge, Piling, Loading and Hauling
- 10-71 Grading, Road-Bed, Repairing
- 15-27 Grading, Ditch, Excavating
- 62-77 Paving, Subgrade, Shaping
- 63-76 Paving, Headers, Setting

Forms for Materials and Supplies—Form No. 2

The form for materials and supplies should be the same size as that for labor and equipment. The size recommended is 4 1/2 x 8 inches, and should be punched to fit an "end-opening" loose-leaf binder. The material and supplies form is for daily record only. Plate No. 2 shows the material distribution for a concrete paving job. The class code numbers used (60-69) classify the work. The following is the code used in recording the material and supplies:

Daily Report of Unit Costs—Form No. 3

To promote efficiency and to eliminate all wasteful methods a daily cost report should be prepared. Form No. 3 is designed to assemble the daily record of labor, equipment and materials used. When these data have been assembled and the indirect charges prorated to the proper code numbers, all items belonging to the same code numbers should be totaled and divided by the units of work completed. These daily reports can be compiled into weekly and monthly reports. When the general office is not in the field, daily reports are sent to the head office, the general expense added, and the totals assembled into periodical reports. These periodical reports are then checked against the engineers' estimates, or can be used as a check against the original bid estimates.

Form No. 3, as reproduced herein, illustrates the method of assembling the daily records for a concrete paving job. The amount of segregation shown is thoroughly practical, and is complete

Estimate for Job. 26-B - Marin Co., Calif. 2/8/1924 Length 12 Mi.						
Item	Equipment—Crew	Daily Rates	Materials—Supplies	Total for Job	Unit Bid	Extensions
90 Acres, Clearing and Grubbing 600 Trees, 30" Average Size. Boulders; Heavy Brush.	1 Foreman...@	\$ 8.00	\$ 8.00	Powder Stumping.....	\$1,100.00	
	14 Laborers...@	4.00	56.00	Caps, Fuse.....	70.00	
	2 Fallers...@	6.00	12.00	Coal—Forge.....	27.00	
	1 Powder Man@	7.00	7.00	Special—Cables, Rope	200.00	
	2 Teams.....@	9.00	18.00	Miscellaneous Supplies	750.00	
	1 Cat.....@	26.00	26.00	Small Tools, Materials, etc.....	550.00	
	1 Blacksmith @	6.00	6.00			
	Total		\$133.00			
	Workmen's Compensation		4.00			
	Daily Total.....		\$137.00	Job Total.....	\$2,697.00	
Estimated Work-days 72—Idle Time 28 Days—Total 100 Days.						
Idle Time @ \$30 per day.....\$ 840.00						
Labor and Equipment.....9,864.00						
Materials and Supplies.....2,697.00						
Percent Camp-Corral Cost.....720.00						
Freight—Transportation.....401.00						
General Expense.....1,400.00						
Net Profit.....2,438.00						
Divided by 90.....\$18,360.00—204 per acre						
					\$204.00	18,360.00

A FORM DESIGNED TO SUPPLEMENT THE PRESENT STANDARD FORMS USED IN COMPILING ESTIMATES (FORM 5)

enough for the purpose of efficiency studies. The gasoline and oil for mixer, roller, tamper and trucks is shown prorated to the several power units. To avoid confusion, a separate sheet should be used for each construction unit. All forms used for assembling daily cost records should be filed carefully, and at the end of each month should be bound and filed at the general office.

Periodical Report—Form No. 4

Form No. 4, Periodical Report, is designed to assemble the totals of the daily reports. This report form is very similar to the daily report form No. 3, the only difference being that the columns for hours and rates are omitted. The sheet suggested herein is designed to take care of only one unit of construction; that is, a separate sheet should be used for paving or for macadamizing, etc. The totals from separate sheets can always be assembled within a few minutes. It is thought that the sheet suggested herein will cover all the conditions required by the average contractor. As much or as little segregation as is desired can be placed upon this sheet, and fixed charges and general expenses can be added by placing the code numbers in the same code column as for other items. Form No. 4, with the three forms given hereinbefore, completes the list of forms necessary to keep segregated costs in the field.

Pay-roll forms have not been considered herein,

as the method of carrying the pay-rolls has no bearing on the method of keeping costs.

Estimating Forms—Form No. 5

Many contractors are familiar with the present standard form used in compiling estimates. This form is designed to assemble all of the items to be considered in estimating the cost of a particular unit of construction. Form No. 5 cannot always be used to replace the present method, but to supplement it, and should be of advantage to the contractor in compiling and filing estimates. A single sheet (loose-leaf) should be used for each bid unit and should contain the final analysis as prepared for submitting proposals. The form as filled in is general only, and can be revised to fit any condition.

The form suggested is designed to analyze the job costs from the angle of economical organization. The general contractor can immediately picture a working organization that will prove to be efficient under a given condition, and he will also know the class of equipment required. From the economical crew and equipment angle it is not difficult to build up the estimate step by step, taking next the estimate for material and supplies, idle time and general expenses. All calculations in determining unit costs should be made on the back of Form No. 5, which will not only facilitate checking errors, but will become a permanent record of all the items considered.

Cost Accounting, Legal Points, Where to Purchase

When in doubt consult CONTRACTORS' & ENGINEERS' MONTHLY

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

Contractor's Right to Assert Breach of Agreement by Other Party

A contract for an irrigation district improvement provided, in effect, that the contractors should not be required to do any work for which money to pay the same had not first been made available by tax levy. Speaking of the contractors' and their surety's rights under this clause, the Colorado Supreme Court recently said in the case of Aetna Casualty & Surety Co. vs. North Sterling Irrigation District, 225 Pacific Reporter, 261:

"Assuming that this clause with reference to a levy and a separate fund constitutes a condition precedent to the taking effect of the contract, it certainly could be waived by the contractors by beginning work either without insisting upon performance or without stopping to inquire whether the condition had been complied with. They knew, or had the means of knowledge within their reach, of informing themselves about this. Even though the contract of the surety is strictissimi juris, there is no violation of the terms of the contract in this particular of which it may now complain, even if the clause in question was, in part or in whole, for its benefit. . . . This principle is similar to the established rule that where a party to a contract has the right to rescind or not to perform until the other party has done a certain thing, he must exercise his right as soon as he has knowledge, or might have acquired knowledge, of the alleged default. . . . If the contractors might not be obliged to begin work until this condition was complied with, they knew or might have known before they began work that the other party had not complied with it. A party may not 'play fast and loose' at the same time and await results and then make his election. If the surety was injured, it must look to the party that inflicted the injury."

Power of Construction Superintendent to Employ Physician

The superintendent in charge of bridge construction had implied authority to employ physicians to treat employees injured in the course of their employment, according to the decision handed down by the North Carolina Supreme Court in the case of Miller vs. Cornell-Young Company, 122 Southeastern Reporter, 383. The Court said:

"The question presented to us is: Did Hogan have authority to employ plaintiffs to administer to a human employed by him when broken and fatally wounded in the work of his master, the defendant company? If Hogan was superintendent of the construction and had entire charge, had authority to buy materials and repair and mend the broken machinery and employ and discharge the workmen, did he not have implied

authority to authorize plaintiffs to care for and administer to the broken and fatally injured employee, under the facts and circumstances of this case?"

Teamster as "Employee" Under Workmen's Compensation Act

One Herron was held by the Minnesota Supreme Court to be an "employee" of a paving firm within the meaning of the Minnesota Workmen's Compensation Act, in the case of Herron vs. Coolsaet Brothers, 198 Northwestern Reporter, 134.

The circumstances of the case were as follows: A firm contracted to construct sewers. The contract forbade the subletting of any part of the work without the consent of the city. A member of the firm agreed with Fontaine that he, having a team and wagon, could haul pipe from car to places on streets at 50 cents per ton. Fontaine reported this to his friend Herron, who also had a team and wagon, and these two men agreed to work together "fifty-fifty." They reported for work, and the member of the firm, being informed of their plan to work jointly, permitted them to proceed and gave directions and, while Herron was hauling a load of pipe along a paved street, he fell from his wagon, causing his death.

Effect of Illinois Safety Provisions

An Illinois statute declares that scaffolds, ladders, supports, etc., used in constructing, painting, etc., structures shall be so constructed as to give adequate protection to workmen, etc. It is further provided that staging shall, where practicable, have a safety rail attached, etc. Referring to this statute in the case of John Griffiths & Son Company vs. National Fireproofing Company, 141 Northeastern Reporter, 739, the Illinois Supreme Court lately said:

"The act of 1907 imposes upon the contractor and the owner, as well as upon subcontractors, foremen, or others engaged in the work, the duty of complying with the provisions of the act so far as the civil liability is concerned. . . . Before the enactment of this law, where work was done under such circumstances as to constitute the person doing it an independent contractor, the owner was not liable for an injury caused by the negligence of such independent contractor. . . . Since the enactment of the law, the owner of the property and every contractor and subcontractor are equally bound by the act to comply with its provisions, and in case of willful failure are liable to the party injured for any direct damages sustained by reason of such failure. This liability to the person injured the owner or original contractor cannot evade by any contract with the contractor or subcontractor."

Criminal Misrepresentations Concerning Title to Property

Under a statute providing a penalty for obtaining property under false pretenses, a seller of real estate was guilty of such offense in misrepresenting that there were no incumbrances against the property, excepting a certain mortgage, when, in fact, there were lienable claims on account of unpaid bills for labor and materials, although no liens had been filed, the time for filing them not having expired. That is the principal point decided by the Minnesota Supreme Court in the late case of *State vs. Anderson*, 199 Northwestern Reporter, 6. The Court said:

"Mechanics liens attach and take effect from the time the first item is furnished. . . . The land is made subject to the burden of paying the lien. The real estate is just as available for the payment of liens, even before they are filed, as to pay an unrecorded mortgage which is certainly an incumbrance. . . ."

"Defendant says that the right of the lienholder is merely an inchoate right which the claimant may assert or which he may not assert, and, whether or not it is claimed, depends wholly upon the will or whim of the person having the inchoate right. We think it more than that. It is not inchoate, nor in the beginning, nor is it in itself incomplete. It actually exists—true, it may terminate in so far as the property is concerned if the lien statement is not filed within the 90 days."

Contradictory Clauses in Contracts

Concerning construction contracts containing inconsistent provision, the Texas Court of Civil Appeals lately said in the case of *Griffin vs. Shamburger*, 262 Southwestern Reporter, 144:

"The general rule is, with reference to contracts executed upon blank forms, that where there is an ambiguity because of apparent inconsistencies between the written or typewritten portion on the one part and the printed instructions on the other, the written or typewritten words will control, because the written words are the immediate language and terms selected by the parties themselves as setting forth their intention, while the printed form is intended for general use without reference to particular objects and aims."

Contractor's Liability to Third Parties

"The general rule is that, after the contractor has turned the work over, and it has been accepted by the proprietor, the contractor incurs no further liability to third persons by reason of the condition of the work, but the responsibility, if any, for maintaining or using it in its defective condition is shifted to the proprietor," declared the Oklahoma Supreme Court in the recent case of *Armstrong vs. City of Tulsa*, 226 Pacific Reporter, 560. "The contractor remains liable, if at all, only to the proprietor for a breach of his contract. . . . And it has been held that all the acceptance that is required by a proprietor of the work of a contractor, in order to relieve the contractor from liability for injury to third persons after the acceptance, is a practical acceptance after the completion of the work; a formal acceptance not being required."

Workmen's Compensation Liability

A riveter at work on a building made a fire in a tub for his own comfort, though he had a fire in his forge. He threw upon the fire a substance that exploded, set his clothes on fire, and was burned fatally. Under these circumstances it was held in the case of *Strand vs. Harris Structural Steel Co.*, decided by a New York court and reported in a bulletin issued by the New York Industrial Commissioner, that the workman's dependent family had no valid claim under the Workmen's Compensation Act. The court finds that it was not customary for riveters to have such fires for their comfort and that the employer did not furnish the explosive substance. His acts, the opinion declares, "were not natural incidents of his work; they did not enable him the better to do his work or discharge his duties."

Road Contractor's Agreement with Bond Dealer Upheld

It is legal for a public contractor to agree to pay a bond dealer a certain sum to induce him to bid at least the lowest price at which bonds issued for work awarded conditionally to the contractor may be sold, holds the United States Circuit Court of Appeals, Fifth Circuit, in the recent case of *W. L. Slayton & Company vs. Newton & Morgan*, 299 Federal Reporter, 279.

Defendants were awarded a road contract subject to sale the following day of an issue of bonds to defray the cost. Defendants, doubting that the bonds would bring the minimum legal price, 90 per cent of par value, agreed to give plaintiff, a bond dealer, 5 per cent of the amount of the bonds if plaintiff would bid at least 90 per cent. Plaintiff accepted the offer and bid a little more than 90 per cent, but the bonds were awarded to a higher bidder.

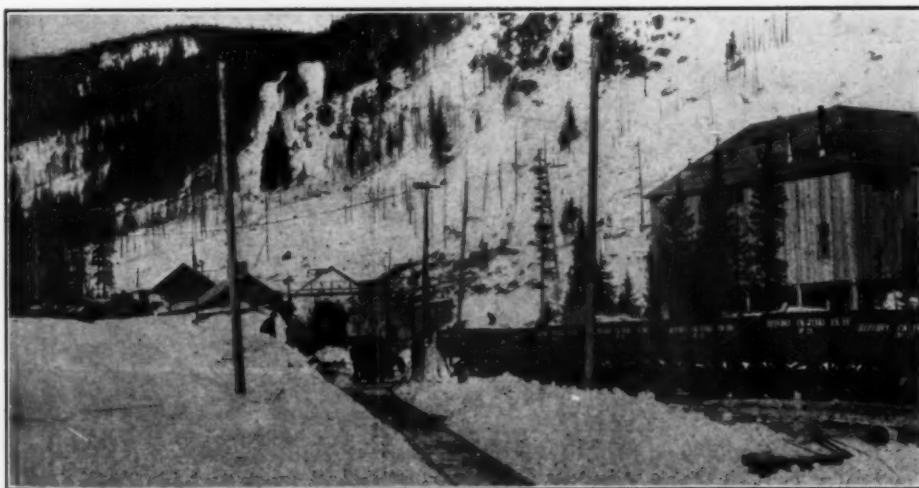
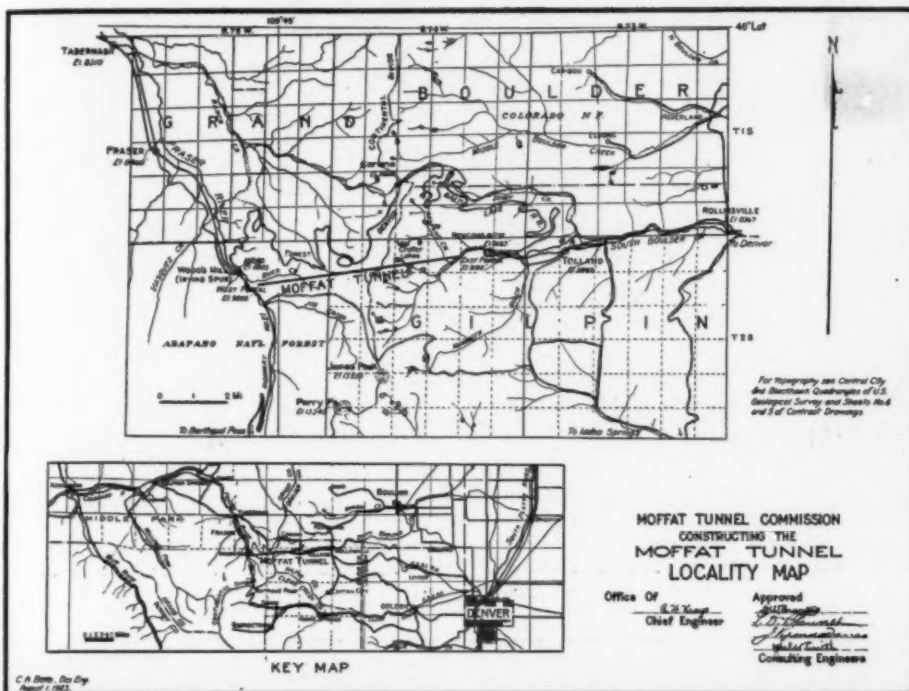
To plaintiff's suit to recover the agreed 5 per cent compensation for placing the bid, defendants replied that the agreement was void as being without consideration and against public policy. The Circuit Court of Appeals overruled the contention, saying:

"In Louisiana the consideration need not be expressed in a contract, but will be presumed until the contrary appears. . . . Moreover, plaintiff's promise to underwrite and guarantee a valid sale of the bonds, so that funds would be available for the construction of the road, constituted a consideration for defendants' promise to pay. . . . The contemplated bid was not to be submitted until the next day, and in the meantime the plaintiff, except for his agreement, would have been at liberty to change his mind and not make an offer for the bonds. Nor does it make any difference that the plaintiff did not purchase the bonds. His undertaking was that they would be sold at a price authorized by law, and that was the whole purpose of the contract. . . ."

"It is conceded that there is nothing in the constitution, or the laws, or the decisions of the Supreme Court of Louisiana, which prohibits such a contract as was entered into in this case. In these circumstances, it is not for this court to declare the contract between the parties void on the ground that it is opposed to public policy."

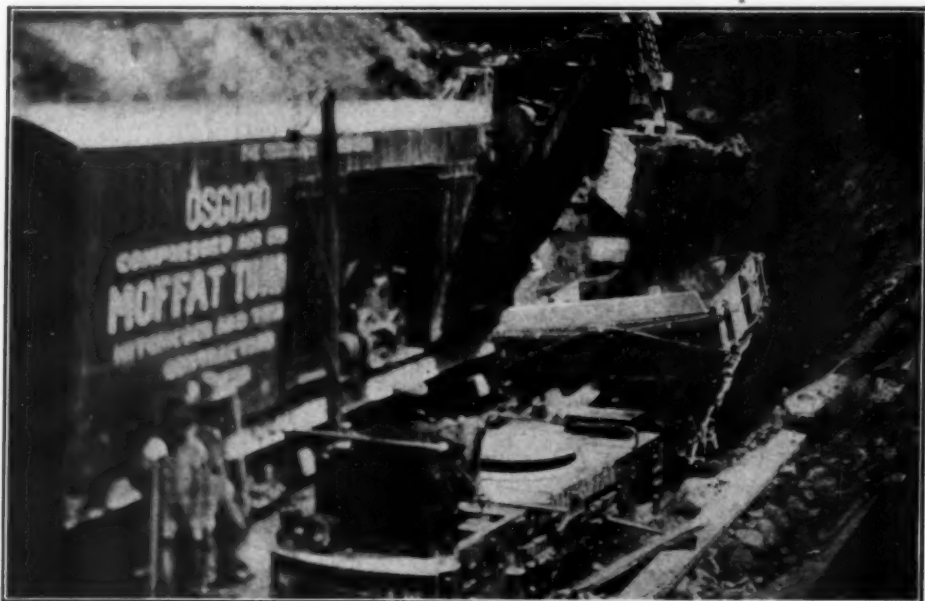
Construction Scenes from the Moffat Tunnel

Six-Mile Railroad and Water Tunnels Progressing Rapidly



THE EAST PORTAL OF THE 16 x 24-FOOT MOFFAT RAILROAD TUNNEL NEAR DENVER, COLO.

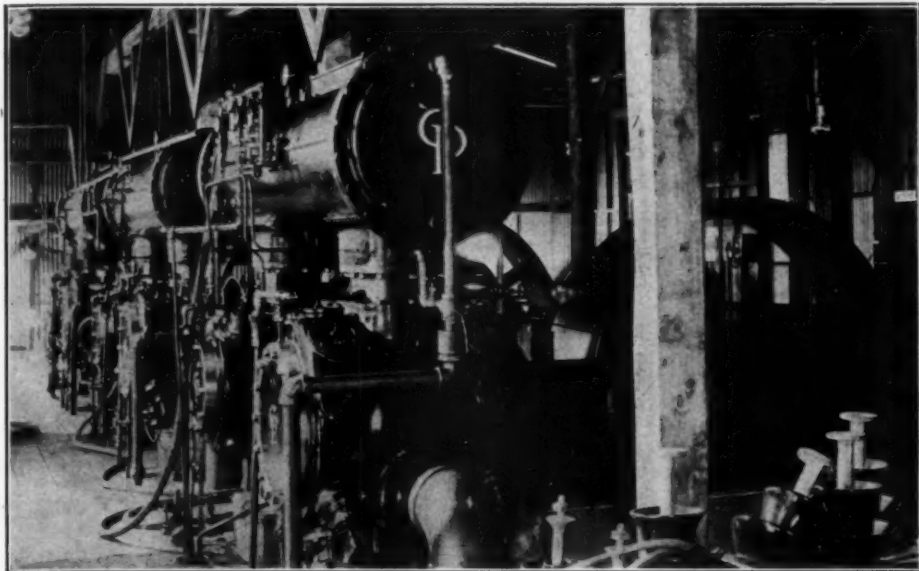
The railroad tunnel enters solid granite at an elevation of 9,200 feet with a 3 per cent ascending grade which meets the 9 per cent grade of the West Portal, near the middle of the bore, at elevation 9,242 feet. The contractors, Hitchcock & Tinkler, Inc., expect to finish both the railroad and the water tunnel before July 20, 1927, the date set for completion, as every day before that means a bonus of \$1,000



OSGOOD AIR SHOVEL CLEARING UP OPEN CUT AT RAILROAD PORTAL, SHOWING THE SOFT EARTH, WHICH, WITH THE DECOMPOSED GNEISS FARTHER IN, REQUIRED HEAVY TIMBERING FOR OVER 3,000 FEET



NEEDLE-BAR METHOD OF CARRYING THE HEAVY TIMBERING AHEAD THROUGH SOFT GROUND. The roof segments are supported by 24-inch and 12-inch I-beams until posts can be set after shooting. The posts are 12 x 12-inch Oregon fir timbers; 3-inch lagging is used.



COMPRESSORS FOR FURNISHING AIR FOR OPERATING MACHINERY AND FOR VENTILATION

Three 1,200-cubic-foot-per-minute Chicago pneumatic compressors with one 500-cubic-foot Ingersoll-Rand compressor at the East Portal, and a similar installation, all Ingersoll-Rand machines, at the West Portal, furnish air at 110 pounds pressure for the drills, air shovels, pumps, etc. Low-pressure air for ventilating is furnished by two Roots blowers, 100-h.p., 4,000-cubic-foot capacity at 4-pound pressure

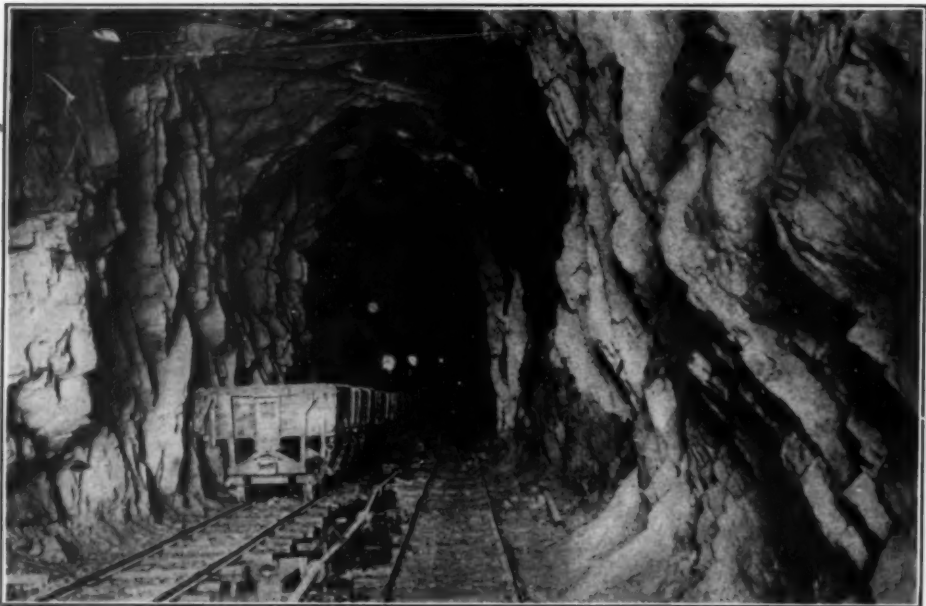


A DRILL CARRIAGE WHICH WILL TAKE CARE OF FOUR DRILLS

The use of this drill carriage not only permits set-ups to be made in from 8 to 15 minutes, but facilitates alternating mucking and drilling between the water tunnel and main headings, which are excavated by the same bonus crews



THE 8 x 8-FOOT MAIN HEADING IN THE BACKGROUND IS HERE SHOWN WIDENED TO 16 FEET PREPARATORY TO TAKING OUT THE 10-FOOT BENCH THAT REMAINS. THE ROCK IS GREY GRANITE-GNEISS



FULL-SIZE 16 x 24-FOOT STANDARD SINGLE-TRACK RAILROAD TUNNEL. BOTH RING SHOOTING FROM THE CENTER HEADING AND BENCH METHODS OF EXCAVATING ARE BEING USED



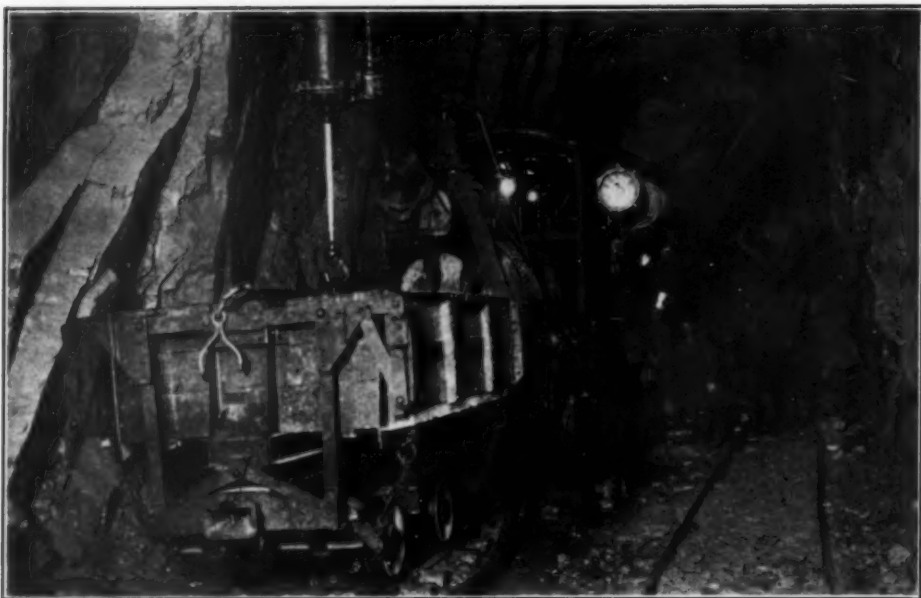
GENERAL VIEW AND ENTRANCE TO THE 16 x 24-FOOT RAILROAD TUNNEL PORTAL SHOWN AT THE RIGHT

The bridge goes across the open cut to the contractor's office, and change-and-dry house. A 240-h.p. General Electric trolley locomotive and roundhouse are shown in the foreground with a string of 4-yard cars at the dock ready to receive muck from the water tunnel. The 50-cu bic foot Koppel cars operate at a grade of 8 feet above or opposite the center of the Railroad Tunnel. In the background the Continental Divide rises to an elevation above 12,000 feet



CROSS-CUT NO. 1 AT ITS INTERSECTION WITH THE 8 x 8-FOOT WATER TUNNEL, WHICH IT CONNECTS WITH THE RAILROAD BORE 75 FEET NORTH AND PARALLEL

A 24-inch gage is used in the heading and a 36-inch gage in the large tunnel. Wiring, the 12-inch ventilating pipe, the 8-inch high-pressure air pipe, and the 3-inch water pipe are carried in the water tunnel and the cross-cuts, keeping the main bore clear



THE 75-H.P. OSGOOD AIR SHOVEL WITH $\frac{1}{4}$ -YARD BUCKET LOADING 4-YARD KOPPEL CARS IN THE RAILROAD TUNNEL

The car-lifting device at the rear of the shovel saves the time usually required to switch empties



AN ELECTRICALLY-OPERATED CONVEYOR MUCKING MACHINE WITH BELT CONVEYOR IS HERE SHOWN LOADING A 50-CUBIC-FOOT KOPPEL CAR IN TWO MINUTES

These machines operate in an 8 x 8-foot heading, being run back several hundred feet on the 24-inch gage track when drilling or shooting operations are in progress

Building Conditions in the United States

Prepared by S. W. Straus & Company

1924 Six Per Cent Ahead of 1923

BUILDING activities throughout the country during the first nine months of the year were 6 per cent ahead of the corresponding period in 1923. For September, the gain over the same months last year in building permits and plans filed in the 305 leading cities and towns of the country covered by the survey, was 9 per cent.

The total for the nine-months' period was \$2,733,000,000, compared with \$2,568,000,000 last year. The Eastern and Southern sections showed creditable gains, while the Central and Far Western states revealed slight losses.

Among the large cities, New York made an outstanding record during the three-quarters of the year, the total in plans filed for the period being \$81,693,000, compared with \$75,015,000 last year,

a gain of \$106,678,000, or nearly 20 per cent. Detroit, Philadelphia, Boston, San Francisco, Milwaukee, Baltimore, Dallas, Denver, Providence, Louisville and Rochester made worthy gains.

Every section of the country displayed increased activity in September as compared with the same month in 1923, although the gain in New York was nominal, while Chicago displayed a \$5,000,000 decline.

The twenty-five leading cities gained about \$12,000,000 over the same month last year and slightly more than \$5,000,000 over September, 1922. Outstanding gains for the month were recorded in Detroit, Cleveland, Boston, San Francisco, Washington, Milwaukee, Indianapolis, Cincinnati, Denver, and Providence.

RECORD OF 25 LEADING CITIES SHOWING VOLUME OF PERMITS ISSUED AND PLANS FILED FOR NINE-MONTHS PERIOD, WITH COMPARISONS

	% 1924	% 1923	Sept., 1924	Sept., 1923	Sept., 1922
1. New York—P. F.	\$681,693,000	\$575,015,784	\$45,748,315	\$44,104,374	\$49,528,756
2. Chicago	221,683,020	252,895,967	22,228,200	27,374,705	12,263,100
3. Detroit	123,737,811	98,345,411	12,524,789	9,708,727	10,014,311
4. Los Angeles	117,412,082	145,321,093	13,090,467	14,099,353	10,267,394
5. Philadelphia	115,444,115	101,857,590	8,665,805	7,086,060	11,714,140
6. Cleveland	48,739,400	45,733,065	4,833,725	3,857,650	6,837,905
7. Boston—P. F.	41,672,673	30,795,809	3,906,119	2,701,512	2,289,549
8. San Francisco	39,858,899	34,089,996	5,671,754	2,907,389	2,951,558
9. Milwaukee	36,105,726	28,111,718	6,992,512	3,216,501	2,058,942
10. Washington, D. C.	34,107,446	39,664,568	4,379,062	2,492,668	4,808,429
11. Baltimore	33,856,476	28,859,451	2,737,000	2,151,840	3,648,540
12. St. Louis	26,046,947	31,295,965	2,783,960	5,592,630	1,715,117
13. Pittsburgh	25,714,334	25,619,958	1,985,234	1,814,383	5,609,762
14. Newark, N. J.	25,593,381	22,763,487	1,558,284	2,576,292	2,124,943
15. Rochester	23,817,162	15,131,294	2,076,729	2,017,667	1,310,315
16. Oakland, Cal.	23,271,527	19,949,233	2,502,144	2,147,296	1,789,439
17. Portland, Ore.	22,781,700	19,905,770	2,548,575	2,378,060	1,534,005
18. Seattle	22,510,990	19,546,713	1,439,970	1,403,825	1,345,820
19. Buffalo	21,980,536	19,949,000	1,835,536	2,831,000	3,408,000
20. Indianapolis	21,655,438	20,856,990	2,607,980	1,650,949	1,928,956
21. Dallas	20,780,164	17,666,957	2,472,733	2,005,895	1,856,488
22. Cincinnati	19,669,510	20,264,235	2,511,590	1,637,435	2,629,000
23. Denver	19,653,350	16,391,950	3,002,150	2,011,000	1,508,000
24. Providence	19,211,300	16,844,700	1,922,100	1,482,900	1,667,200
25. Louisville	17,979,074	13,995,866	3,000,235	1,320,107	964,375
Totals	\$1,804,976,151	\$1,660,962,570	\$162,824,998	\$150,980,218	\$145,874,709

NOTE.—P. F. indicates figures are for plans filed instead of permits issued.

No. Cities	Sept., 1924	Sept., 1923	% 1924	% 1923	Gain or Loss Sept.	Gain or Loss %
88 Eastern	\$107,658,720	\$95,580,138	\$1,307,311,267	\$1,133,012,925	\$12,077,982	+174,298,342
100 Central	90,124,320	87,986,110	829,673,551	848,360,534	+12%	+15%
44 Southern	22,595,920	18,080,199	225,784,010	200,498,472	+2%	+25,285,538
73 Western	40,726,801	38,998,787	371,105,089	386,307,000	+25%	+12%
305 Cities	\$261,105,761	\$240,645,234	\$2,733,873,917	\$2,568,179,021	\$165,604,527	+6%

Miscellaneous Notes

Our Front Cover Illustration

WE are indebted to the Beckwith Machinery Company, Pittsburgh, Pa., and to the T. L. Smith Company, Milwaukee, Wis., for the interesting photograph appearing on the front cover of this issue of **CONTRACTORS' AND ENGINEERS' MONTHLY**.

The work illustrated is a portion of the contract of the Charles Winters Construction Company on Route 69, Armstrong County, Pa. The Winters Construction Company had approximately 6 miles of this route to build through a more or less mountainous section of Armstrong County. The illustration shows the Smith paver working on a $9\frac{1}{2}$ per cent grade, which is a fairly steep grade for concrete work. This was no exception to the hills on the job or to the wide curves, of which there were fourteen in the 6 miles. Some of the grades ran as high as $10\frac{1}{2}$ per cent. This 6-mile job of 18-foot road, 6 inches thick at the sides and 8 inches thick at the center, was poured in $2\frac{1}{4}$ months' time.

New Holt Distributors

THE Holt Manufacturing Co., Peoria, Ill., has announced the appointment of the Holt Texas Equipment Company, Inc., 217-221 South Market Street, Dallas, Tex., as its distributors for Caterpillar tractors in the state of Texas. R. S. Lowe of Dallas is President of the company and has associated with him a number of salesmen who for a considerable time have been connected with the former Texas distributors of this company, the Holt Company of Texas, Inc.

The Highway Supply Company, 417 Washington Avenue, North, Minneapolis, Minn., has also been appointed distributors for Caterpillar tractors in Southern Minnesota and Western Wisconsin; and the Dyar Sales & Machinery Company, 66 Broadway, Cambridge, Mass., has been appointed distributors for Caterpillar tractors in eastern Massachusetts, Vermont, New Hampshire and Rhode Island.

The Omaha Road Equipment Company, 702-712 South Tenth Street, Omaha, Nebr., has been ap-

pointed distributor for "Caterpillar" tractors in the state of Nebraska and the adjacent counties in Iowa. C. E. Miller of Omaha is President of the company, and associated with him are a number of men who have had long experience in the sale of tractive and other road machinery in this territory.

Heed Appointed Vice-President of Garford

THE Garford Motor Truck Company, Lima, Ohio, has announced the appointment of Rushmore B. Heed as Vice-President in charge of sales. Mr. Heed has been active in the motor truck industry since 1916, when he left the automobile insurance field to join the sales force of the Diamond T. Mr. Heed's headquarters will be at the Garford factory in Lima.

American Institute of Steel Construction

THE annual convention of the American Institute of Steel Construction will be held at the French Lick Springs Hotel, French Lick, Ind., on November 13-15, 1924. An educational program has been prepared which includes subjects and speakers that will assure a large attendance. In addition to the regular members, all who are interested in the fabrication or use of structural steel are invited to be present as guests of the Institute.

New Steel Foundry for P & H Co.

THE Pawling & Harnischfeger Company, Milwaukee, Wis., has recently added a large steel foundry to its equipment for the production of heavy crane and excavating machinery. This foundry was formerly operated by the Hercules Steel Casting Company for commercial production, but is now entirely devoted to the steel castings required for the production of P & H machines. When operating two shifts, this foundry will be able to turn out all of the 400 tons of carbon-steel and alloy-steel castings used each month in P & H machines.

The Pawling & Harnischfeger Company has announced the appointment of P. H. Sackett, 3445 Hennepin Avenue, Minneapolis, Minn., as its representative in Minnesota and North and South Dakota.

Error in August Caption

WE wish to correct an error in the caption of the upper illustration on page 61 of the August issue of **CONTRACTORS' AND ENGINEERS' MONTHLY**, which has been called to our attention by the manufacturers and by Charles Carswell, Assistant Engineer of the Delaware River Bridge Joint Commission. The manually controlled hammers which were used to accurately trim down the surface of the main pier before the steel tower bases were erected were furnished to the contractor by the Dallett Company, Philadelphia, Pa., and not by the Ingersoll-Rand Company, as stated in our caption.



THE NEW P & H FOUNDRY BUILDING

Steel Forms Help Make Smooth Roads

"Unevenness of Side Forms Is an Inexcusable Construction Defect and Results in an Uneven Surface."—A. T. Goldbeck, U. S. Bureau of Public Works

THE problem confronting highway departments and road contractors who take pride in their work and are determined to give the taxpayer a road that is straight, true and smooth, can be solved only in one way, and that is by the use of reliable steel side forms that will stay absolutely true and smooth throughout the construction of the road. The form must be light enough to be handled economically, and strong enough to stand maximum abuse.

The steel road forms made by the Blaw-Knox Company, Pittsburgh, Pa., are designed in cross-



DRIVING THE STAKE TO SECURE ADJACENT SECTION OF FORM TO LINE



LOCKING THE FORMS BY A SINGLE HAMMER STROKE

section so that they furnish inherent stiffness. The material itself is 3/16-inch steel, and to keep the form straight it is reinforced at three points along its length and at the joints. The top flange is further reinforced in order to secure stiffness and smoothness of surface, by a drop edging of 1 3/16 inches. An unusually wide base, from 4 to 6 inches, forms the bottom flange, which further stiffens

the form and furnishes sufficient bearing area to sustain finishing, tamping and subgrading machinery. The lock-joint connection insures a true joint, preventing waves in the road.

The staking system 'locks' the form to the ground and prevents sag in the form which might be caused by a loose or moist subgrade. Regardless of the strength of the form itself, if the connecting device is weak, the entire system cannot be depended upon. The lock-joint connection is made by a heavy flanged plate. The plate acts like the angle-bar on a railroad rail and prevents the forms from sagging or developing waves in the road at



LOCKING THE FORM TO LINE AND GRADE BY AN EASILY INSERTED KEY



AFTER THE LOCK-JOINT IS FORMED, ONE MAN SETS THE OTHER END OF THE FORM EXACTLY TO LINE

the joints. A road form 10 feet long, if permitted to sag at the joints, will necessarily develop corresponding waves in the road unless extra labor, care and attention are exercised, with a consequent increase in cost of finishing. Most state specifications require a checking of the road surface by means of a 10-foot straight-edge, and if any inaccuracy or lack of smoothness is discovered, it must be bush-hammered. Many a contractor has suffered a considerable loss in profits because his finished road was not smooth enough.

Staking

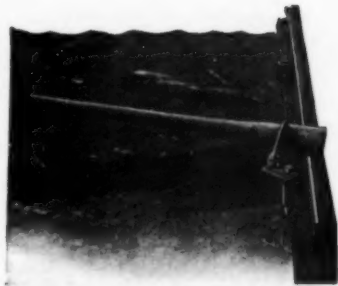
The first requirement of a satisfactory staking system for road forms is to prevent the forms from overturning, settling or changing alignment. This can be accomplished by pointed $\frac{3}{8}$ -inch round stakes, three to each 10-foot section, to which the forms are locked by means of a key, thus preventing any possible movement in the form itself. In view of the rigid requirements for a smooth road, which means that there cannot be any break in the grade line, the staking system must perform a second or double function of preventing the form from sagging or settling either at the joints or along its length. In Blaw-Knox forms the stakes are able to support the load imposed upon the form, as the form itself is hung on the stakes and locked by a key.

Setting the Forms

After the first steel form is set to line and grade, the following forms automatically set themselves to line and grade at the joint because of the lock-



IT IS EASY TO REMOVE A SECTION FROM BETWEEN TWO OTHERS ALREADY STAKED TO LINE AND GRADE



REMOVING STAKES WITH A STAKE-PULLER

ing device. A single hammer stroke locks the two forms together securely and positively. Following this, the workman sets the other end of the second form to line and secures it by driving the stake. In order to secure the form to the established grade line, the form is lifted along the stake and locked by driving the key. The remaining two stakes in each 10-foot section are driven and the form is locked to them after a sufficient quantity of forms have been set to line and grade ahead of the work. There are no right- or left-hand forms in the Blaw-Knox system, all forms being of identical construction, and they can be set on either side of the road or between two other forms at any time. The forms are easily removed by means of a stake puller or a form puller, which makes it possible for two men to pull a 10-foot section complete with three stakes in one stroke.

Placing Plaster By Machine

New Mortar Gun Replaces Several Laborers and Speeds Up Work

A MACHINE which has been placed on the market by Albert Oliver & Son, Inc., 717 East 140th Street, New York City, under the name of "Samson Mortar Gun," is said materially to reduce the cost of placing quantities of mortar as now used for interior walls, ceilings and partitions, and for exterior plastering on backgrounds now in general use. The average capacity of each gun is about 8 cubic yards per day of eight hours. This quantity of mortar, placed $\frac{1}{2}$ -inch thick, equals 5,184 square feet or 576 square yards; or placed 3 inches thick equals 864 square feet, or 96 square yards.

One man operating the gun illustrated, requires five laborers in each gang in placing scratch work. An additional plasterer is required for darbying and straightening up on the brown coat for both interiors and exteriors, but in placing the dash finish on exteriors, the extra man is not required, and two laborers may be dropped from the exterior finishing gang. The manufacturer claims that 2,000 yards of first-class dash finish can be placed in eight hours by one plasterer with three laborers attending. Compressed air is used for operating the Samson Mortar Gun, only a 60-



A MORTAR GUN OPERATED BY COMPRESSED AIR

cubic-feet-per-minute compressor being necessary. This machine was used to place the interior plas-

tering in the new Johns-Manville Building, at 41st Street and Madison Avenue, New York City; the Pierce Foundation Corporation Garage, at 141st Street and Southern Boulevard, New York City; the Phelps Manor Clubhouse at Teaneck, N. J.; the Cedarshore Hotel at Sayville, Long Island, and is being used extensively on new plaster work

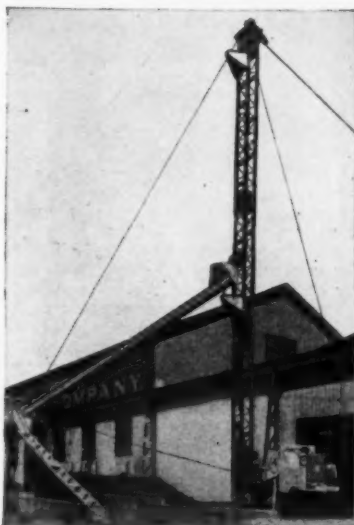
in Tokio, Japan. Its use is revolutionizing building methods, whether applied to use as a wall and partition builder for living houses, or to any type of interior or exterior plastering, as it will readily handle as much work as can be erected by six plasterers in the same time when working on brown mortar.

A New Concrete Chuting Plant

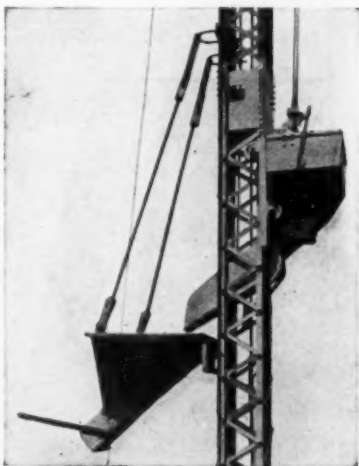
Manufacturer Calls New "Straight Chute" Equipment "Monkey-on-a-Stick"

THE new "straight chute" concreting plant which has been added to the line made by the Ransome Concrete Machinery Company, 1771 Second Street, Dunellen, N. J., is a chuting plant built in two sizes, having bucket capacities of 7 and 14 cubic feet of wet mixed concrete. The smaller bucket can be used on either a steel or a wooden mast, the larger on a steel mast only. The wooden mast is built by the user. The steel mast is furnished by the manufacturer in 15-foot sections up to a height of 135 feet and comes completely equipped with 12-inch top and bottom sheaves for the hoisting line and for swinging the chute.

Three types of plant are available with this new Ransome equipment. The boom-chute plant, used with the steel mast only, has the first chute and half of the second entirely supported by the mast. A plant of this kind with a 32-foot boom chute and swivel-head chute will handle a 80 x 80-foot structure and chute all of the concrete directly into place. Supported swivel-head chuting can be added to increase the range of operation as needed. The second type is the continuous-line plant which has the end of the first chute from



CHUTING PLANT WITH STEEL MAST



BUCKET USED WITH SLOPING BIN

the mast carried either by a tripod or gin pole, or by a block and fall from a cable run over the top of the mast. This equipment can be used with either the steel or the wooden mast. The third type, the bin plant, is used on jobs where it is desired to wheel the concrete, and can be used on the same mast as a continuous-line plant.

The operation of this "Monkey-on-a-Stick" plant is very simple. The short-swinging chute between the bucket and swivel-head chute, or bin, is pushed out of the way of the bucket as it goes up and drops back under the gate by its own weight. The concrete flows in a straight line from the bucket to the bin or chute. Openings every 7½ feet in the steel mast take care of the various elevations necessary for proper chuting. The erection and dismantling of the plants are made fast and easy by its special make-up. The manufacturers claim that the outfit is one that economically solves the problem of elevating concrete on small jobs, either of the chute distribution or of the wheeling type.

When in doubt, see "Where to Purchase," pages 3-45

Two Types of Conveyors for Contractors

Portable Machines Have Special Features to Facilitate Material Handling

PORTABLE, power-operated conveyors up to 60 feet long, and with equipment to raise and lower the point of discharge, have been developed by the Barber-Greene Company, Aurora, Ill., in its Styles N and O conveyors, the latter having a cleated belt with cleats 2 inches high, spaced every 18 inches. The rollers which carry the belt completely on the Type N conveyor do not permit the belt to drag on the edges or travel in a groove. Both the carrying belt and the return belt are carried on steel rollers 4 inches in diameter, equipped with Alemite fittings for lubrication. All of the bearings are protected from dust by being built with dust-proof casings.

The conveyors are supported by Warren truss frames which combine light weight with great strength. The individual sections making up the frame are made from 3 to 15 feet in length, permitting changes in the field to a different length at any time after the machine has been used. Butt joints connect the sections with wrought iron castings. For convenience in shipping from one job to another or for storage of the machine, the intermediate sections of the frame are so built that they can be quickly knocked down. Heavy construction is necessary at the hopper end of the conveyor, as this end receives the greatest abuse, no matter what kind of material is handled. For easy shoveling into the conveyor, for convenience in unloading drop-bottom cars, or hopper-bottom cars with a track hopper, a low conveyor hopper has been built into this machine. Quick and easy adjustments can be made on the pulley in the Barber-Greene hopper. A long, protected screw leads up from the tail pulley. Because of this arrangement, adjustments can be made while the

hopper end is underneath a car or engaged in other similar work.

The return belt is protected throughout in its entire length by curved sheet metal housing. When operated by an electric motor, the motor is protected by being mounted inside the conveyor frame, where it is most easily protected from the weather and from accidental damage. When a gas engine is used, it is placed at the side of the frame on the conveyor truck, keeping the additional weight and vibration off the frame. It is also placed in an accessible position for the operator where it will receive proper attention. The truck has a strong quick-acting hoist, so located that the man operating it can stand clear of the conveyor frame. There is also a brake which facilitates lowering.

A One-Man Conveyor

The Barber-Greene universal Type "U" conveyor, which is made without power, or equipped with a 3-h.p. motor or a Fuller & Johnson gasoline engine, and is particularly adaptable for pit work, for loading trucks, in building construction and other contracting work, has many notable features. The capacity of the belt is considerably increased by full-length skirt-boards, which make it possible to carry large lumps of material along by the cupped cleats and prevent the lumps from falling off. The machine has continuous side cleats and cupped cross cleats, the form of which prevents the belt bearing down and wearing. The cupped cross cleats exert a digging effect as they pass around the pulley at the hopper end and materially increase the carrying ability of the belt.

The discharge height of the machine can be



A GROUP OF TYPE "N" CONVEYORS AT WORK

quickly changed by means of a crank by one man. The crank operates a self-locking worm winch, designed for safety as well as for speed. Because of its special construction, this Type U conveyor can discharge at a height of 11 feet 9 inches, although it is only 22 feet long. Both the head and tail pulleys are steel and the belt is driven through the head pulley, so that it is actually pulled with its load. The frame is made of 4-inch channels, providing strength with light weight and simplicity in design. The return belt is protected throughout its entire length from falling particles, which otherwise might gather at the tail-end pulley and cause trouble.

The conveyor has a low hopper for placing under cars, for easy shoveling, and for any work in which a low receiving end is a convenience. The lower end is open, as it is oftentimes convenient to shove the end of the conveyor into the base of a pile, and then shovel or rake the material down to it.

One of these conveyors, used by Pierce and Piron, Aurora, Ill., with one man working on the bank, was able regularly to screen and load 2 yards of sand in six to seven minutes. In loading from stock piles, B. A. Miller, Wyaconda, Mo., says that on the average he can load from 200 to 300 cubic yards



A TYPE "U" CONVEYOR WITH CLEATED BELT

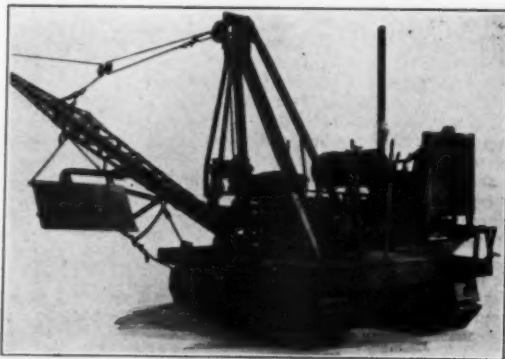
of 2-inch rock per 10-hour day with this Type U conveyor.

A Powerful and Speedy Back-Filler

A Substantial Machine That Cuts Labor Cost on Filling Trenches

ON regular work, H. D. Churchill, contractor, Los Angeles, Calif., used a Buckeye back-filler made by the Buckeye Traction Ditcher Company, Findlay, Ohio, to refill trenches which were 15 feet deep and 3 feet wide, and it cost him an average of only 1.4 cents per yard to get the dirt back into the trench. He filled a stretch of 500 feet every 8 hours. In Cleveland, the Haddad-Kairal Construction Company backfilled 1,500 to 1,600 feet of trench in 8 hours with one of these machines. The trench was 7 feet deep and the top often 8 feet wide, as the soil was very "cavey."

The Buckeye back-filler is a sturdily-built machine, the boom of which can swing around for a half-circle, making it possible to accomplish a great deal of work with one set-up. All the levers are within easy reach and all parts readily accessible for adjustment. The back-filler is mounted on full-length multiplane traction treads, which make it easy to travel on any soil or city pavements without injury to the surface. The traction has a separate drive on each side, making quick, short turns possible. The traction consists of cast steel treads, each 13 inches wide and 7 feet 6 inches long, center to center of drive sprockets, giving a bearing area of approximately 15 square feet. The road gage is 49 inches inside and 6 feet 3 inches outside of the treads. The general dimensions of the machine, without the boom, are over-all width 8 feet, over-all height 9 feet 6 inches, over-all length 10 feet 6 inches. The boom is built up of structural iron, rigidly



A MOBILE BACK-FILLER MOUNTED ON CRAWLERS

braced 10 inches square at the center and 5 inches square at each end. A 4-inch box channel extension gives an over-all length of boom from 25 to 30 feet. The elevation and working angles of the boom are controlled by power through a worm and gear mechanism.

The scraper is self-filling, built of steel, and 48 inches wide with rooters and cutter. The scraper has a working speed of 150 feet per minute and a return speed of 300 feet per minute. The machine is powered with a heavy-duty tractor type 4-cylinder gasoline engine, rated at 30 h.p., at 800 revolutions per minute.

Brand Your Equipment and Stop Thievery

The Simple Burning of the Company's Name on Equipment Prevents a Great Many Losses

ONE of the large expenses of contracting, and one which is really a leak that is sometimes overlooked, is the frequent purchasing of new tools and equipment to replace that which has been stolen or accidentally appropriated because the ownership is not definitely indicated. Shovels, picks, wheelbarrows, wooden horses, scaffolding, planks, and many other types of tools and equipment are among those things which easily disappear.

Sometimes outsiders pick up shovels, saws, or other tools which every man can use. Sometimes there are a number of contractors on a single job, or on jobs close together, and the equipment gets mixed up in such a way that one of the contractors loses. Sometimes another contractor borrows and forgets to return; or possibly he appropriates anything regarding which there is any doubt as to ownership. Sometimes the workman takes home tools which he needs at home, or which he wants as equipment when he goes to another job. Sometimes the workman simply takes a favorite tool home in order that he may be sure of having it when he again gets back on the job. Many of these tools never return.

This doubt as to ownership is one of the most frequent causes of irritation on every construction job. Disputes are constantly arising as to the ownership of tools, ladders, scaffolding, planks, etc., which are brought to the job by practically all the different trades. Hardly a job goes through without some contractor missing some part of his equipment, due to his failure to permanently and unmistakably mark his ownership on his own material. In the aggregate this relatively small leak represents a substantial loss to every contractor.

This loss means more than simply the cost of replacing missing tools and equipment. The time when tools and equipment are missed is the time they are most needed in the work. Sometimes it is only one man that is delayed while equipment is obtained, but sometimes a dozen men or a whole gang are held up. Or, the entire job may be brought to a standstill, with wages still continuing, while missing equipment is replaced.

The need for an inexpensive and simple branding outfit, one that could be used to permanently brand and mark the ownership of contractors' tools and equipment, has been apparent for many years. But, with the old system, where the tool has to be



A BRANDING IRON THAT STAYS HOT IN SERVICE

reheated every few seconds, the method was too cumbersome and costly. The Everhot Manufacturing Company, Maywood, Ill., has recently placed on the market a branding iron which stays hot and brands continuously, the heat being furnished by a torch which serves as the handle of the equipment. The torch burns gasoline and once lighted brands continuously for hours without relighting or refilling. The Everhot torch can be taken out on the windiest and stormiest days and it will not blow out, but will work effectively and continuously under the most unfavorable conditions. This branding outfit is light and portable and can be carried anywhere a man can work, because its heat-generating source is a part of the tool.

The branding outfit is also arranged to be used as a soldering outfit or a blow torch. It greatly increases the amount of soldering that can be done, because the soldering iron stays hot at a uniform temperature and does not have to be returned to the fire every few minutes.

New Type of Sidewalk Developed at Quincy, Mass.

A NEW kind of sidewalk now being tried out by the Public Works Department at Quincy, Mass., bids fair to give excellent results at a cost far less than that of the older kinds. It may solve the problem of good footways in outlying sections, thus helping to keep pedestrians out of the way of automobile traffic. The composition is mixed asphalt, a substitute for granolithic. It has been introduced on Coddington Street in Quincy, where the Highway Depart-

ment has built a new sidewalk between Woodward Avenue and Valley Street, about 1,000 feet.

The new combination, asphalt and crushed stone, has been used at Hull and other towns on the Massachusetts south shore and has rendered good service. It has a twofold advantage, according to the Commissioner of Public Works; first, it costs about \$1 a square yard, one-fifth as much as granolithic; and, second, it is ideal for sidewalk construction across, or adjacent to, swamps.

Welded Piping in Buildings

By H. E. Wetzell

The Smith & Oby Company, Cleveland, Ohio

THE applied science of pipe welding is comparatively old, but its field has recently been extended to the welding of piping systems in buildings. Almost simultaneously from different sections of the country have come reports of making piping installations in buildings with the aid of the oxyacetylene blowpipe. These reports indicate that rapid strides are being made with this development, which is vitally interesting to piping contractors, because it affects their work, procedure and processes.

The oxyacetylene process has been used for some years as an important and accepted means of fabricating piping in the shops of individual companies and pipe lines in the field. That it has proved successful and economical in these applications predicates its advantages to the building industry. The men who specify welding for pipe lines and plant piping are usually the owners themselves, who, being free to choose their own methods, select the oxyacetylene welded pipe joint because of its strength, durability, tightness and economy. But the men who propose oxyacetylene welding of building piping are subject to the desires or specifications of the owner, architect or engineer of the building.

To this condition can probably be attributed the fact that the practice of welding building piping is only at this time getting into full swing. The authorities mentioned had to be convinced, and they have been convinced. The passive interest heretofore shown by these authorities in the welded pipe joint was probably largely due to lack of complete information on the subject. One engineer, for instance, thought a branch was welded to a main line by cutting a hole in the main line large enough to permit entrance of the branch, which was then welded in without any one's knowing its amount of projection into and consequent obstruction of the main line. On the contrary, however, the branch is not inserted into the main line. The procedure in making a branch



WELDED BENDS IN AN INTERIOR PIPE

connection is to shape out the end of the branch pipe with a cutting blowpipe, so that it will fit the contour of the main pipe. Then the branch is butted up to the main and the latter marked by chalking around the circumference of the branch. Next, a hole is cut in the main line inside of the chalked circle, but equal in diameter to the inside of the branch. Finally, both the hole in the main line and the end of the branch are beveled, fitted and welded, giving the equivalent, so far as internal pipe friction goes, of a cast fitting. And such is the case with the whole story of welded piping—a little investigation will quickly uncover its advantages.

The welded joint is stronger than any of the types of threaded joint. This is manifest when one considers that in threading a pipe its wall is appreciably cut into, thus reducing its transverse strength, in some cases as much as 50 per cent. In the case of the welded joint, however, especially where the weld is built up, the strength at least equals, and in most cases exceeds, the strength of the pipe wall itself.

Installation time and expense are saved when piping is welded. Consider the advantage of taking



A SERIES OF WELDED HEATING COILS

standard lengths of pipe to the job, then merely putting them in position, cutting and fitting them with the cutting blowpipe, then welding adjacent lengths together with the welding blowpipe. All thread cutting, leading, packing and calking is avoided. Also, the use of the oxyacetylene process for this work obviates the necessity of a very detailed piping layout and the necessity of using a specifically marked length for a certain location.

The direction of run of the pipe line can be altered at will. It is merely necessary to cut butting ends to the desired angle with the cutting blowpipe, then weld them together. Special fittings are unnecessary.

In fact, no fittings are necessary other than valves and those which can be readily fabricated on the job from the pipe itself. This fact also has a material effect on the cost, in that the expense of the cast fittings is avoided. Furthermore, since the use of fittings is avoided, the weight and hence the handling time and cost of the piping material is materially decreased, especially in power installations.

The corrosion which usually takes place at threaded joints and the leakage at gaskets and threads of flange connections, is avoided when pipe joints are welded. The weld, when built up, makes the joint the thickest part of the pipe line and, therefore, the part which offers most resistance to corrosion. Hence, the life of an all-

welded pipe line is determined only by the life of the pipe itself.

Alteration of piping can be readily handled by means of the oxyacetylene process. For example, take the simple case of adding a branch to a main line. The work required consists merely in cutting a hole in the main line with the cutting blow-pipe, then welding the branch to the main line. Contrast this with the work required should the job be handled with screwed connections. A whole length of pipe would have to be removed, cut, and threaded, the branch connection threaded and the three resultant ends joined by a cast "T" connection; in other words, two joints to break, two cuts to make, three threads to cut, and, finally, five joints to make. Again, summarizing the oxyacetylene method of doing the job—two cuts to make and bevel, and one joint to weld.

In all, the advantages of welding building piping are summed up in the following statements: Strength is increased. Close work and numerous branch connections are easily handled. The cost of thread cutting and fitting is done away with. The added weight of fittings is avoided, thus reducing handling costs. Corrosion which usually takes place at threaded joints is insured against, as is also leakage at threads and gaskets. So it can be readily seen that the use of welded piping in buildings is both economical and practical.

Improvements in One-Man Excavator

Machine Handling a $\frac{3}{8}$ -Yard Shovel Fills Gap Between Hand Labor and Expensive Equipment

THE new model one-man excavator which has been developed by the Bay City Dredge Works, Bay City, Mich., contains many improvements over its earlier model. This machine, which can be operated by one man, is capable of handling a $\frac{3}{8}$ -yard shovel, or a $\frac{1}{2}$ -yard clamshell or dragline. The new model machine is lighter in weight than the old model, is more sturdily constructed and takes up less room in the pit. It is now powered by a Hercules 4-cylinder engine, and the belt drive has been replaced by a direct gear and pinion-drive connection to the motor. The swing drum, swing cable and A-frame cross-bar have been eliminated by a worm-gear slewing arrangement at the bottom of the boom.

The front mast has been eliminated, so that there is nothing in front of the operator. The rear wheels have been increased to 30 inches in diameter. A square dipper handle has been substituted for the round dipper handle, and the front A-frame is constructed of steel instead of timber. The roof is made of sheet metal in place of wood. The steering wheel has been placed directly behind the operator, so that he can do his own steering or use the wheel for a seat when the machine is not in motion. The framework of the new model excavator is solidly riveted together, instead of being bolted, and the new machine can be shipped completely assembled, with the exception of the crawler tread and wheels, which must be removed when loaded on a flat car.



FRONT VIEW OF NEW EXCAVATOR

Skilful Handling Simplifies Erection of High Steel Mast

Rigging for Cableway Placed in Remarkably Short Time

RECENTLY a Sauerman engineer supervised the installation of a 125-foot steel mast for a slackline cableway excavator plant that was being rebuilt and enlarged. His account of the work is of more than ordinary interest, as he explains how a mast of this size, weighing 22,300 pounds, can be erected with a minimum expenditure of time and effort.

The mast foundation and hoist were in place when the mast sections arrived on the scene. All standard Sauerman steel masts are fabricated at a structural steel shop and shipped to the site of the proposed installation in two or three sections, depending upon the height. This mast was shipped in three sections.

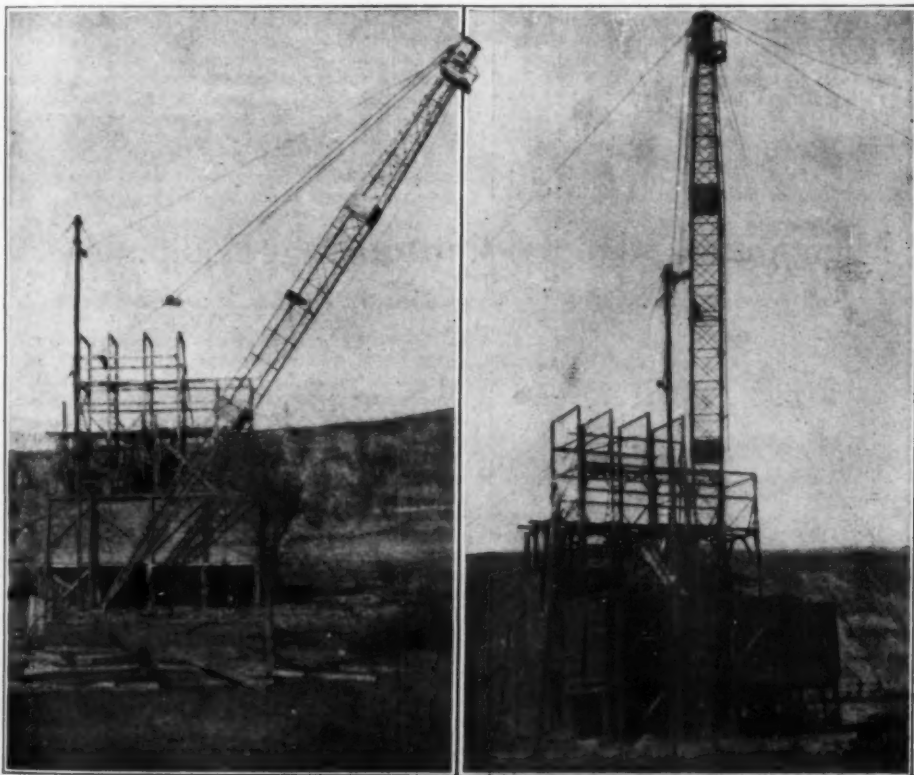
The lower section, 45 feet long, tapering from 5 feet 5 inches square to 13 inches square at the bottom, was placed on the ground at an angle of about 15 degrees from the center line of the hoist and at such a distance from the mast foundation that a space of about 14 inches separated the

ball casting of the swivel base attached to the lower section of the mast from the socket casting fastened to skid timbers bolted onto the foundation.

The middle section, 45 feet long by 5 feet 5 inches square, and the top section, 35 feet long and tapering from 5 feet 5 inches square to 2 feet square, were then put in place and the three sections bolted together. The next step was to attach the platform, also the ladder.

Now followed the work of rigging the mast so that it could be raised with precision and safety.

Two anchor logs, 10 inches in diameter by 12 feet long, were placed at a distance of 15 feet from the socket casting and about $22\frac{1}{2}$ degrees each side from the center line of the mast. A $1\frac{1}{4}$ -inch wire rope bridle was used to keep the mast from sliding ahead while raising. One end of the rope was clipped with three wire rope clips to one log, then brought around the bottom section of the mast, then to the other anchor log. This cable was drawn up tight and then clipped with



TWO SCENES IN THE RAISING OF STEEL MAST ON PREPARED BASE FOR SLACKLINE CABLEWAY

three wire rope clips.

The six guy cables (four of 1¼-inch diameter and two of 1-inch) designed to keep the mast in place after erection, were then attached with open sockets and angle shackles to a disk plate swiveling on a 5½-inch diameter gudgeon shaft projecting above the top of the mast. Two of the guy cables were anchored at right angles to the base of the mast a distance of 250 feet each way from the socket casting. Logs 12 inches in diameter by 14 feet long were used for anchors. A sling cable with open socket at one end was passed around each log and fastened with clips. Each log was then buried 6 feet in the ground and the guy cables attached to the open socket of the sling cable, using a thimble sheave and shackle and four wire rope clips to complete the connection. Another guy cable was stretched out directly in line with the mast and anchored, after allowing the proper amount of slack so that later, when the mast was erect, this cable would be taut.

The usual gin-pole employed in raising a mast is made by lashing together two timbers of ample thickness and proper height to form an A-frame. On this job, however, an old mast was available for use as a gin-pole. A single guide block was attached near its top and further down (about 40 feet from the ground) a thimble sheave with shackle was lashed in place.

The track and tension cables of the slackline cableway excavator were next brought into use. The former was anchored at a distance of about 100 feet back from the mast foundation and in a straight line with the mast, then led through the thimble sheave on the pole and a triple block and single block attached to the loose end. This triple block was the lower tension block of the permanent mast-top assembly, and the single block, after serving its purpose in aiding the erection of the mast, became the load-line guide block of the permanent installation. The tension cable was

fastened to the rear drum of the hoist, reeved through the guide block at the top of the pole, then through a guide block attached to a band on the upper section of the steel mast, then to the triple block at the end of the track cable, and back and forth between this and the upper triple tension block near the top of the steel mast until all three sheaves were reeved. Then after being reeved through the single block attached to the track cable, the dead end was carried down to the center of the mast and securely fastened with four clips. The final act was to draw up the track cable tightly enough to bring the lower triple block about 15 feet from the pole in a horizontal plane. When the track cable had been thus tightly drawn up and clipped securely with four clips, all was in readiness to put the rear drum of the hoist in operation and raise the mast.

The actual raising of this mast as pictured on the front cover, from the time it left the ground until it was upright, consumed about twenty minutes. The work that remained to prepare the cableway for operation, after the mast was fully erect, was as follows: The forward main guy was first attached so that the tension cable could be slacked off, the three other main guys being already in place, as previously mentioned. The two auxiliary guys were next attached. All guys were drawn up taut with the aid of a chain hoist and each securely fastened with four wire rope clips. The track cable was swung around to the bridle cable anchorage and attached, and the bucket and carrier put in place on the track cable. The tension cable was re-reeved for cableway operation. The load cable was attached to the front drum of the hoist, reeved through the load-line guide block, which had been moved to its proper position in the mast-top assembly, and the dead end attached to the dump block of the bucket and carrier assembly. The cableway was then complete and ready to dig its first load.

Manganese Steel in Contracting Equipment

This Remarkable Iron Carbon Alloy Containing 11 to 13 Per Cent Manganese Has Many Adaptations

THE terrific wear to which excavating and dredging tools and machines are subjected makes it necessary to use a metal which is particularly tough and has remarkable wearing qualities. Manganese steel, which is an iron carbon alloy containing 11 to 13 per cent manganese, is hard, though not as hard as tool steel, but it is rather its toughness that is so extreme as to resist even the action of the best tool steel. Amsco is the trade name of the manganese steel made by the American Manganese Steel Company, Chicago Heights, Ill., for contracting equipment.

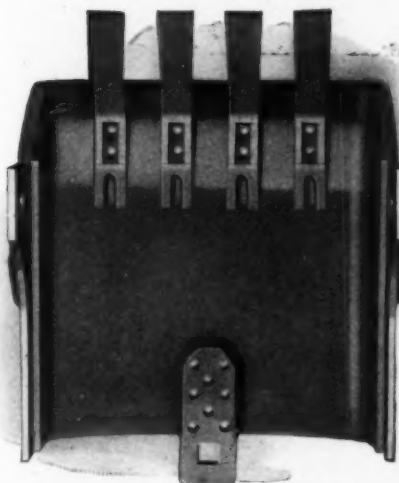
Dippers

Operators of power shovels and dipper dredges are familiar with the necessity for strong integral castings in the construction of dippers, because of the hard and continuous strain of daily use. The Missabe dipper, equipped with the Vanderhoef front, is said to meet this need, as the dippers are made throughout of Amsco manganese steel. The teeth bases are cast integrally with the front. In

addition to providing great strength and increased service, at a point where vitally needed, this feature effects a decided saving in time required for making repairs. There are no bases to replace, and no base stocks to carry. The cost of points is also greatly reduced. The shape of the points and the reversible feature make it possible to wear away approximately 65 per cent of the metal before scrapping the castings. It is estimated by one company that during the fifteen months preceding the adoption of the Vanderhoef front upon all their shovels, they could have saved approximately \$5,600 or slightly under 50 per cent of the cost of their dipper teeth, if these fronts and reversible teeth had been used.

Dipper Teeth

While it is true that two-part reversible dipper teeth have been used for many years with a marked degree of success, it is also true that difficulties were experienced, especially under severe service, due to the points becoming loose and drop-



THE SMOOTH INSIDE OF THIS DIPPER FRONT GREATLY REDUCES THE POSSIBILITY OF MATERIAL CLOGGING BETWEEN THE TEETH

ping off the dipper. The Clark reversible dipper tooth of manganese steel was designed to overcome this trouble and also to provide an efficient tooth for all kinds of digging. The special features claimed for these teeth are that the points can be easily reversed by removing only one bolt; the wedge type bolt enters through the side and assures perfectly tight fit of point on base; there is no danger of the point becoming loose or dropping off, as there is no sheer or strain on the bolt and the bolt is placed through the heavy portion of the base and point; the side lugs on the point fit into corresponding lugs on the base and prevent the base from spreading, thus eliminating the effect of side thrust; the maximum strength with the minimum weight is secured by making the shank portion of I-beam construction.

The Mullally reversible dipper tooth made of manganese steel is one of the latest developments in two-part reversible tooth construction. Although of recent design, it has been thoroughly tested under the most severe working conditions and has been found satisfactory. The advantages claimed for this tooth are that two bolts are provided for holding on the points; there is no direct strain on either bolt, so that there is no danger of either point becoming loose; the bolts are put in on an angle and tapered so that the point can be drawn up perfectly tight on the base; a complete cross flange is provided on the base portion so that all strains, either horizontal or vertical, will be transmitted to at least three of the flanges at one time; there are four individual tapered flanges on the base so that points will automatically tighten when digging, and also tighten when put under side strains; lugs are provided at the intersection of the base and point, making a positive lock.

Crushers

Wear- and shock-resisting metal of a very extraordinary kind is required for the wearing parts

of gyratory and jaw crushers. During recent years many operators of this class of equipment have, for this reason, abandoned the use of ordinary steel and cast iron parts and adopted manganese steel, which is recommended particularly for crusher heads, mantles, concaves, wearing plates, chutes, gears and pinions, dust rings, dust caps, spider arm shields and pipe wearing plates.

Screens

One of the interesting qualities of Amsco manganese steel is that under abrasion it gets smooth, and as it gets smoother it gets tougher and more resistant; the abrasive process is retarded rather than accelerated as it goes on. This is a quality peculiar only to manganese steel and is one of the reasons why this metal is so successfully employed for wearing parts of all kinds of screening machinery.

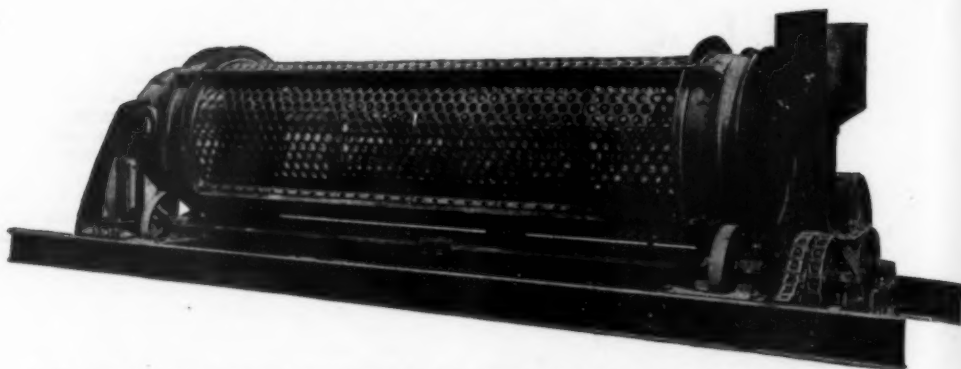
Where materials such as crushed stone, coal, ores, gravel, clay, etc., are handled, screens are subjected not only to extreme abrasive wear, but also to intermittent shock loads. Manganese steel, due to its high elastic limit and resiliency, is able to withstand, without breakage, the shock loads which cause screens made from other metals to fail. In addition to longer life and freedom from breakdowns, manganese steel screens provide greater screening efficiency, as the holes maintain their size and shape for longer periods. The holes are cored instead of punched, and it is possible to provide them with a slightly outward taper, which prevents materials from becoming wedged in the holes and decreasing the efficiency of the screen.

Chain Conveyor and Bucket Elevator Equipment

The two qualities most desired in chain drives are durability and immunity from breakdowns. The shock-resisting qualities of manganese steel, and the manner in which it withstands frictional and abrasive wear, make the use of this metal desirable for chains, sprockets, traction wheels and



THE BASE PORTIONS OF THE TEETH ARE CAST INTEGRALLY WITH THE FRONT OF THIS DIPPER



A ROTARY SCREEN MADE OF MANGANESE STEEL WITH THE HOLES CORED OUT, WHICH PREVENTS WEDGING OF MATERIAL IN THE HOLES

elevator buckets. Simplex rivetless chain is a heavy-duty detachable chain, the links and pins of which can be easily and quickly assembled or detached without the use of tools. It is exceptionally strong and the combined feature of simplicity, strength and the unequalled wearing qualities of manganese steel are said by the manufacturers to command the favorable attention of users of elevating and conveying chain. This chain is furnished with either center-drive pins or outside-drive pins. The latter are recommended, as the strain is distributed evenly upon the pins and most of the wear taken from the links, thereby prolonging the life of the more expensive center links and decreasing the cost of maintenance.

Sheaves

Manganese steel, being the greatest wear- and

shock-resisting metal made, is ideal for use in the manufacture of sheaves. The American Manganese Steel Company has received many inquiries as to the effect of manganese steel sheaves on steel cables. It is believed that they prolong the life of the rope for the following reasons: Metals which have a tendency to disintegrate or break off in small particles, under wear service, are referred to as friable metals, such as cast iron and carbon steel. Manganese steel on the other hand is a non-friable material. Microscopic examination of the structure of manganese steel reveals a metal of great density, where the particles are more closely combined than in any other metal. These elements are so tightly held together that under severe service the wearing surface does not chip or crumble off, but assumes a high polish, reducing friction to a minimum.

Illinois Claims World's Records in Road Building

ILLINOIS completely shattered existing road-building records during the week ending July 31, according to a statement issued by the Illinois State Division of Highways. The construction report for that week announced three new world's records, and indicates that a fourth will be established during the present season.

During the above-mentioned week, a total of 60.79 miles of pavement was constructed, exceeding by 3.09 miles the world's record for one week's construction established in 1923. The 1923 record week was not reached until the month of October, and officials of the Division of Highways are optimistic over the possibility of even further surpassing the mark this construction season.

Another world's record fell when the W. C. Menelly Company, working on Route 2 between Decatur and Pana, laid 2,671 feet of standard 18-foot concrete pavement in one day with one mixer. This completely eclipses the world's record established by the same contractor in 1923, when 2,017

feet of pavement were laid by one mixer in one day.

In the week ending July 31, the same paving outfit set another new record when it completed 10,405 feet of standard 18-foot pavement. The previous record for the output of one mixer in one week, established earlier in the present season, was 9,463 feet, while last year's record was 7,419 feet.

During the above-mentioned week, 116 large paving mixers were operating on the highways throughout the state, and there were employed directly on road work 11,000 men and 3,000 teams.

The pavement constructed thus far this year has reached a total of 561.01 miles, or approximately 85 miles in excess of the amount completed on the same date last year. During 1923, a world's record for the amount of pavement constructed in one year was established when Illinois completed 1,085 miles. There is now little doubt that Illinois will also break this record before the end of the present season.

FEATURES OF NOVEMBER ISSUE

The November issue of **CONTRACTORS' & ENGINEERS' MONTHLY** will have several particularly timely articles covering the proper plant for concrete work, laying a subaqueous water-main in Minneapolis, making concrete more workable, bidders' bonds versus certified checks, and an unusually interesting series of short descriptive articles covering new equipment.

Bonding the New Philadelphia Subway Construction

Surety Bonds Aggregate More Than \$15,000,000

THE National Surety Company and twenty-two other surety companies recently executed two bonds aggregating in excess of \$15,000,000 for the Keystone State Construction Company, guaranteeing the completion of the Broad Street subways in the city of Philadelphia, contracts for which were recently awarded to the Keystone Company. The contract was divided into two sections, one being for \$8,200,000 and the other for \$7,100,000. The Keystone State Construction Company, Philadelphia, Pa., was the lowest of four bidders on both sections of the undertaking by more than \$500,000. Fifty per cent construction bonds and 10 per cent penal bonds were required on each contract. The bonds were executed for \$4,100,000 and \$3,550,000. Combined, the undertaking is one of the largest ever handled by any contracting firm under bond in the country.

The bonds cover the construction of a portion of the Broad Street subway from Stiles to Clearfield Street. A four-track system is to be constructed in North Broad Street, and the total distance to be covered by both contracts is 10,130 feet. This is one-third of the total length of

the four-track subway system to be constructed in Philadelphia and the contract specifies three stations. The work must be completed by January 31, 1927.

The nature of the undertaking precludes the use of mechanical equipment in digging, so that hand shovel methods must necessarily be employed. By the "cut and cover" system, plank flooring will cover the sections open in Broad Street so that traffic can be maintained in safety during the progress of the work. The aggregate cost of the task per foot is about \$1,400.

The subway will extend the entire width of Broad Street with a cut of approximately 30 feet. The contract covers undercrossing of sewers and relaying of water pipes in adjacent parallel streets and also includes the temporary decking of the surface for street traffic. Work will be handled from 15 shafts working in both directions from each shaft. Penalties for delay consist of damages actually suffered by the city of Philadelphia for actual direct expense of engineering, supervision and inspection of the work during the period of construction.

Construction Work on the Lowenstein Building, Memphis, Tenn.

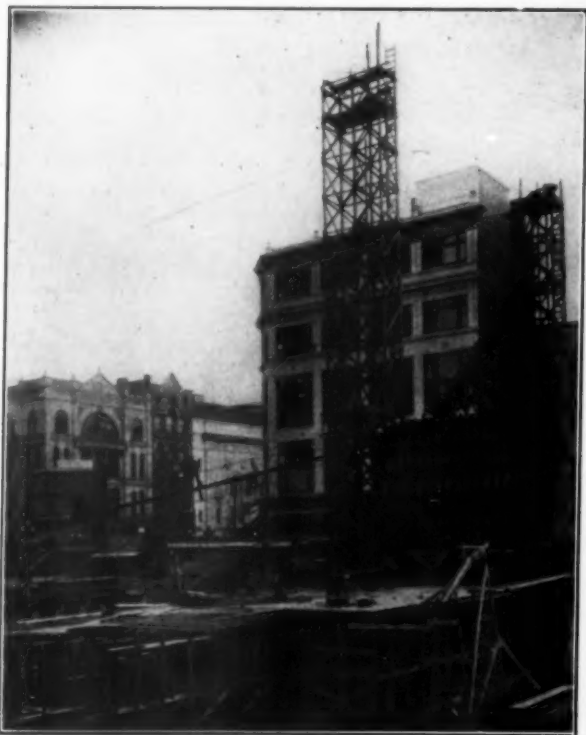
An Interesting Example of Modern Methods in Finance and Building Construction

THE construction of the new Lowenstein Building at Memphis, Tenn., by the Gauger-Korsmo Construction Company, Memphis, Tenn., and St. Paul, Minn., is an interesting example of coordination. Less than nine months ago on the site of this building the Peabody Hotel was caring for its guests. To-day a new Peabody Hotel is being built a few blocks away and, where the original hostelry once stood, the Lowenstein Building is completed. B. Lowenstein & Company, Inc., the tenants for whom the building is being built, have already moved from their present location, so that in less than a year from the time the Peabody Hotel closed its doors B. Lowenstein and Company are operating a department store on the identical site but in a new fire-proof building. The accomplishment of this result required the concentrated efforts of the Peabody Company, the owners, and the building contractors.

The contract for the wrecking of the old Peabody Hotel was awarded to the W. J. Newman Company on August 16, 1923. It was stipulated in the contract that the contractor was to be given possession of the building on September 1, 1923, and that the work of wrecking the building was to be completed in its entirety by November 15, 1923. On October 30, 1923, the Peabody Company awarded a contract to the Gauger-Korsmo Company, to erect on this same site a nine-story reinforced concrete building. The contract stipulated that the contractor was to be given possession of the prem-



EXTERIOR OF THE LOWENSTEIN BUILDING PRACTICALLY COMPLETE



CONCRETING PLANT ON THE LOWENSTEIN BUILDING JOB

ises on November 19, 1923, and that the building was to be finished on August 1, 1924. There was some delay in connection with the excavating but the construction work did not stop. Wherever conditions permitted, the work was carried on. By February 1, the sixth floor was poured and the hanging scaffolds set and the second floor terra

cotta belt course finished. This was accomplished only by concentrated effort, work going on night and day. March 16 saw the concrete work completed and one month later, on April 16, the brick work was finished and the copper cornice partially completed.

Work on the inside had gone on in the same manner as the outside work. In order to do this the entire first floor was boarded in soon after it was poured and the sash set throughout as soon as it was possible to do so. Plastering work was started as soon as the brick work was far enough advanced and plasterer followed bricklayer from floor to floor. The contractors for the elevators, electrical work, plumbing, heating and the sprinkler system, and all the other subcontractors, were on the job as soon as it was possible for them to get to work, and the work so coordinated that the work of each kept pace with the work of the other as well as with the work on the general contract. Due to this fact there was practically no delay. The building grew from day to day and was built upon the principle that nothing was too difficult to undertake and nothing impossible. The building stands to-day completed, the finishing touches being put on with no slackening of speed but in the same spirit with which the work was started. The concrete plant is shown in the progress picture. The mixing plant was located below the sidewalk level and consisted of a 28-S Koehring mixer, sold to the contractor by W. A. Nelson, Exchange Building, Memphis, Tenn. The concrete materials were delivered to the site in trucks and dumped into a hopper and elevated to bins which fed directly into the mixer.

Principles of Business Conduct

Do You Operate on This Basis Adopted by the Chamber of Commerce of the United States?

THE function of business is to provide for the material needs of mankind, and to increase the wealth of the world and the value of happiness of life. In order to perform its function it must offer a sufficient opportunity for gain to compensate individuals who assume its risks, but the motives which lead individuals to engage in business are not to be confused with the function of business itself. When business enterprise is successfully carried on with constant and efficient endeavor to reduce the costs of production and distribution to improve the quality of its products, and to give fair treatment to customers, capital, management, and labor, it renders public service of the highest value.

We believe the expression of principles drawn from these fundamental truths will furnish practi-

cal guides for the conduct of business as a whole and for each individual enterprise.

I

The foundation of business is confidence, which springs from integrity, fair dealing, efficient service, and mutual benefit.

II

The reward of business for service rendered is a fair profit plus a safe reserve, commensurate with risks involved and foresight exercised.

III

Equitable consideration is due in business alike to capital, management, employees, and the public.

IV

Knowledge—thorough and specific—and unceasing study of the facts and forces affecting a business enterprise are essential to a lasting individual

success and to efficient service to the public.

V

Permanency and continuity of service are basic aims of business, that knowledge gained may be fully utilized, confidence established and efficiency increased.

VI

Obligations to itself and society prompt business unceasingly to strive toward continuity of operation, bettering conditions of employment, and increasing the efficiency and opportunities of individual employees.

VII

Contracts and undertakings, written or oral, are to be performed in letter and in spirit. Changed conditions do not justify their cancellation without mutual consent.

VIII

Representation of goods and services should be truthfully made and scrupulously fulfilled.

IX

Waste in any form—of capital, labor, services, materials, or natural resources—is intolerable and constant effort will be made towards its elimination.

X

Excesses of every nature—inflation of credit, over-expansion, over-buying, over-stimulation of

sales—which create artificial conditions and produce crises and depressions are condemned.

XI

Unfair competition, embracing all acts characterized by bad faith, deception, fraud, or oppression, including commercial bribery, is wasteful, despicable, and a public wrong. Business will rely for its success on the excellence of its own service.

XII

Controversies will, where possible, be adjusted by voluntary agreement or impartial arbitration.

XIII

Corporate forms do not absolve from or alter the moral obligations of individuals. Responsibilities will be courageously and conscientiously discharged by those acting in representative capacities as when acting for themselves.

XIV

Lawful cooperation among business men and in useful business organizations in support of these principles of business conduct is commended.

XV

Business should render restrictive legislation unnecessary through so conducting itself as to deserve and inspire public confidence.



A BRIDGE ABUTMENT JOB HANDLED WITH LIGHT EQUIPMENT

Light Equipment Handles Abutment Job

Bridge Contractor in Illinois Handles Work in Unique Manner

THESE two illustrations of a small bridge job which is being handled by the Herrick Construction Company of Carlinville, Ill., for the state of Illinois, near Quincy, show a good set-up for bridge abutment jobs using light equipment.

The contractor used a Sasgen 1-ton stiff-leg derrick to handle dirt from the abutment. The derrick is operated by a Clyde hoist attachment mounted on a Fordson tractor. This hoist has a line pull of 3,000 lbs., which is sufficient to readily

take care of handling the dirt and also the 2,000-lb. drop hammer which was used from a set of hanging leads to drive all of the sheet piling.

The contractor reports that this small hoisting outfit is doing all that he expected it to do and is doing about everything that a larger, heavier steam outfit which he owns is handling on another job. The equipment was sold to the Herrick Construction Company by the Geo. F. Smith Company, St. Louis, Mo.

The literature now prepared by progressive manufacturers of contractors' equipment is educational and exceedingly helpful. Examine the list of available literature and catalogs on pages 84 and 86.

Types of Safety Tread Floors

The Development of Floors and Stair Treads Which Do Not Become Slippery

THE oldest of the floor products made by the Norton Company, Worcester, Mass., well-known manufacturers of safety floors and stair treads, has been known as Alundum safety tile. This is a semi-vitreous tile, designated as such because of its slight porosity. It was first made in an attempt to solve a difficult problem—that of subway stairs where the daily traffic of thousands scoffed away the toughest of stair-tread materials, necessitating frequent replacements, and where the cost of slipping-accidents had become a matter of deep concern. This semi-vitreous product is used quite generally for stairways in subway and railway stations; for ramps and factory floors where traffic is heavy and danger from slipping is a hazard, and where it is advisable to combine a non-slip surface with a non-wearing surface.

The second step in the development of safety floors is the production of Alundum aggregate tile with its unusual possibilities in color harmony. In this product, vitrified Alundum aggregates are molded with a cement binder into tile shapes and in the form of precast treads. With a variety of aggregate colors and the variety of marble chips available from which the aggregates are usually used in combination, the possibilities in color combination are unlimited. With the monotone effects now being produced, a long-life tread may be installed in association with marble without sacrificing the artistic. A specimen of the marble with which it is to be associated may be employed as the factory color model.

Builders in the past have found it a problem to obtain stair treads, floor slabs and floor tiles of the required durability and artistic appearance for buildings where marble, granite or some other beautiful materials form a large part of the decorative scheme. Now they may select a Norton product that meets the color scheme and secure a floor material which is durable and slip-proof.

Another interesting development in safety floors is the Alundum ceramic mosaic tile, another semi-vitreous product. The slipping-hazard is recognized wherever smooth, highly polished tiles are used for walking surfaces. There are numerous places where the Norton slip-proof product is eliminating the slipping-hazard. To emphasize the applicability of this product, it is necessary merely to mention the store entrance; the dangerous edge of the swimming pool; the slippery pool under the shower-bath; the floors of hotel lavatories and wash-rooms; the kitchens, elevator landings and similar places. The variety of colors available and the possibilities of combining this slip-proof product with other available tile products give a wide latitude in the selection of decorative schemes.



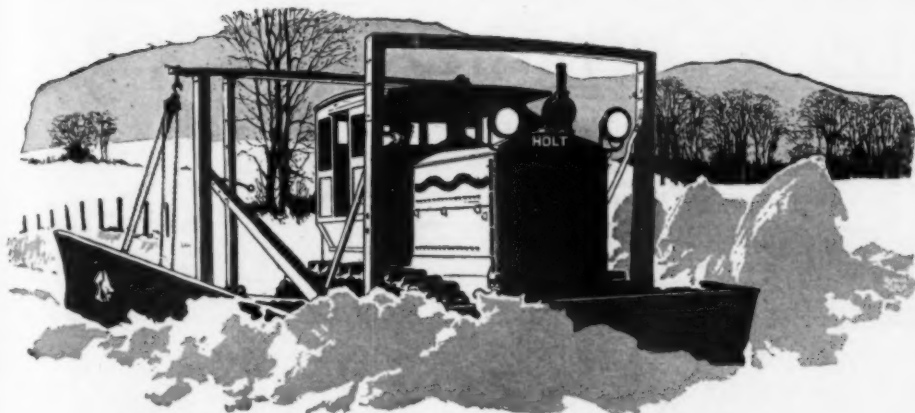
STAIRWAYS THAT HAVE BEEN MADE NON-SLIPPERY WITH ALUNDUM SAFETY TILE

Stair Treads

Experiments with Alundum floor products have led also to the development of stair treads of various types. In addition to Alundum aggregate tread that has found great use in modern structures, such as hotels and hospitals, there is a tread of the mastic mat type, which is meeting the needs for industrial purposes. Mosaic Alundum tiles 1-1/16 inches square are set into a reinforced wire asphalt mastic composition. This type of tread is meeting with success in the modern city bus, and on the floor in front of dangerous machinery, where it is highly important that the man's mind be on his work, rather than on his feet.

Production of the Aggregates

Early experiments in an effort to produce a slip-proof concrete floor by sprinkling abrasive grains on the surface or mixing them with the cement were unsuccessful, except that they led to further experimentation, resulting in the use of vitrified aggregates. The method of producing the aggregates is practically the same as is followed in making abrasive products, such as grinding-wheels, rubbing-bricks and sharpening-stones. They are not by-products. Correct proportions of standard sizes of Alundum grain are mixed with specially prepared clays and then baked in high temperature kilns. The materials are scientifically mixed and bonded, so as to insure uniformity of color, texture and degree of hardness, which are essential to attractiveness and durability in a floor. Thus, instead of using merely the grain of the abrasive, the aggregates, which are made up of many particles of abrasive held together by a vitrified clay bond, are used. When the product comes from the kiln, after vitrification, it is broken or crushed and screened to standard sizes. These various sizes of aggregates are marketed in bulk for use in the manufacture of Terrazo floors.



The Nation's Road Maker

HOLT TRACK PIN

The Holt track pin illustrates the rigid requirements of Holt quality; and it is an important factor in "Caterpillar" strength and endurance. Cold drawn $3\frac{1}{2}$ per cent nickel steel, used in 5-Ton and 10-Ton track pins, has an initial tensile strength of 65,000 lbs. Scleroscope hardness 25 to 30. This stock is subjected to three heat treating operations. (1) Case hardening; to withstand abrasion. (2) Hardening; toughening the core; increasing hardness of case. (3) Drawing; refines metal structure. The track pin emerges from the Holt heat treatment with a tensile strength of 140,000 lbs. Scleroscope hardness of core 40 to 45; hardness of case 75 to 85; doubling initial tensile strength, tripling initial hardness.

Wherever you see "Caterpillars" at work, building or maintaining roads, or on engineering projects of all kinds, you may know that a wise investment has been made for the *right* power equipment. The "Caterpillar" is a real servant; it has rugged endurance; ample power.

With its sturdiness and positive traction, the "Caterpillar" stands the hardest usage; pulling heavy graders, scarifiers, scrapers, maintainers, and every other type of road tool, in the toughest soils; hauling great tonnages of materials and supplies; moving dirt on all kinds of engineering projects; breaking snow blockades on northern city streets and country highways. It is built to work—and built to last.

No other machine has such varied usefulness. Most of your tractive jobs can be done better, quicker and cheaper with the "Caterpillar" than by any other method. Cities large and small, counties, townships, road districts, park boards, contractors, prefer "Caterpillars" because no other power is so economical; no other is so versatile in getting work done at the least cost and in the shortest time. *Our new booklet will interest you. Copy will be sent upon request.*

"THE NATION'S ROAD MAKER"

There is but one "Caterpillar"—Holt builds it.

THE HOLT MANUFACTURING CO., Inc.
PEORIA, ILLINOIS STOCKTON, CALIF.

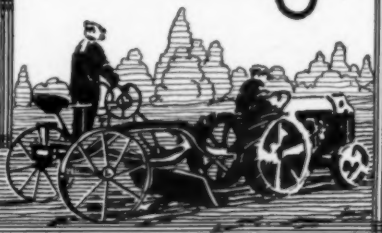
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When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Look Over These Catalogs

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up-to-date on the subject of machinery and equipment.



TRENCH PUMP UNITS

Contractors' trench, sewer, ditch and mud pumps are described in illustrated Bulletin 24-T, which has been recently issued by the Domestic Engine & Pump Co., Shippensburg, Pa.

A ONE-LEVER SHOVEL CRANE

Contractors interested in a light-weight loading device should write to the Autocar Company, Inc., Sireator, Ill., for information regarding its one-lever shovel crane for Fordsons.

LONG-LIVED HAMMER DRILLS

Reasons why contractors should use Wood hammer drills which have positive rotation and long life, are given in the literature of the Wood Drill Works, 30-36 Dale Ave., Paterson, N. J.

SELF-DUMPING STEEL BODIES

Wood self-dumping steel bodies for Ford trucks, which are controlled entirely from the driver's seat, are described in the literature of the Wood Hydraulic Hoist and Body Co., 7935 Riopelle St., Detroit, Mich.

STEEL DUMP-TRUCK BODIES

Hoist-operated dump bodies with double-acting tail-gates, gravity-operated dump bodies with automatic tail-gates, and rocker-type gravity-operated dump bodies, are among the many types of steel bodies made for the contracting trade by the Martin-Parry Co., York, Pa., and described in its literature.

TRUCK-MOUNTED MIXERS

A 7-cubic foot concrete mixer, mounted on a 1-ton truck, known as the Mixermobile, is made by the Milwaukee Concrete Mixer Co., Milwaukee Wis., and is described in its literature.

A SCRAPER ATTACHMENT FOR LIGHT TRACTORS

A tractor-scraper outfit, which is easy to operate and which needs no stopping or backing to operate the scraper, is made by the Miskin Scraper Works, Ucon, Idaho. The scraper is made in four sizes from $\frac{1}{4}$ to $1\frac{1}{4}$ yards capacity, for use with a Fordson tractor.

A ONE-MAN POWER SCRAPER

The Miami-Fordson scraper, made by the Miami Trailer Company, Troy, Ohio, is operated by one man, loading, transporting and dumping from the tractor driver's seat without stopping. This machine is described in illustrated literature which may be secured free on request.

PROPER BRICK HIGHWAY CONSTRUCTION

In a well-prepared illustrated booklet, "The Construction of Vitrified Brick Pavements," which is issued by the National Paving Brick Manufacturers Association, Engineers' Building, Cleveland, Ohio, contractors will find a great deal of accurate, helpful information on the construction of brick streets and highways.

HOW TO USE AND HANDLE SLATE

Contractors can secure a great deal of helpful information regarding the uses and methods of handling slate, by writing to the National Slate Association, 757 Drexel Bldg., Philadelphia, Pa., and asking for its latest literature.

WIRE MESH REINFORCING

Complete information regarding the value, properties and easy methods of handling wire mesh reinforcement in road and other concrete construction, may be secured free from the National Steel Fabric Co., 708 Union Trust Bldg., Pittsburgh, Pa.

AN ALL-STEEL WAGON-LOADING MACHINE

The N. P. Nelson Iron Works, Inc., 212-40th St., Brooklyn, N. Y., makes a wagon-loading machine which has a rigid truck steel frame with steel panels to protect the operator from falling materials. This machine, which is mounted on a standard Fordson tractor, is described in detail in this company's free literature.

BELT-DRIVEN AIR COMPRESSORS

Full self-oiling, belt-driven air compressors with controlled splash and regulatable sight feed cylinder lubrication in sizes giving from 9 to 250 cubic feet of free air per minute, under pressure ranging from 100 to 200 pounds, are described in Bulletin C-3, which may be secured from the Curtis Pneumatic Machinery Co., 1671 Kienlen Ave., St. Louis, Mo.

GRADER ATTACHMENTS

Equalizing lift springs, which are now standard on four of the graders of J. D. Adams & Co., Indianapolis, Ind., and which prevent chattering and pumping of the blade in maintenance work, are described, as well as the new Adams back-sloper attachment, in a leaflet C.E.M. which may be secured by interested contractors free on request.

SAFER SCAFFOLDS

In an illustrated folder, the J. L. Austin Mfg. Co., Menomonee Falls, Wis., describes its Quick-Set scaffold brackets, which have many safety features and when taken down are compact and easy to handle.

A SMOKELESS TAR AND ASPHALT KETTLE

Tar and asphalt kettles in which the temperature may be controlled absolutely, using oil burners, and which are much more compact and more economically used, are described in literature of the Aeroil Burner Co., Inc., Hudson Ave., and Main St., Union Hill, N. J.

A BACK-FILLER ATTACHMENT FOR TRACTORS

A Bull-Dozer or trench back-filler adapted for attachment to 5- and 10-ton tractors is described in detail for municipal officials and contractors in a leaflet issued by the LaPlant-Chaote Mfg. Co., 3015 First Ave., Cedar Rapids, Iowa.

ROCK CRUSHERS, ELEVATORS, CONVEYORS,

SCREENS AND BINS

In a well-illustrated, interesting folder, "Foresight Versus Hindsight," the Good Roads Machinery Co., Inc., Kennett Square, Pa., describes and depicts its complete line of Champion rock crushers, elevators, conveyors, screens and bins for road and building contractors.

WHAT EXPLOSIVE AND WHERE TO USE IT

A very helpful bulletin giving the various brands of explosives and the uses to which they are adapted has been issued by E. I. DuPont de Nemours & Co., Inc., Wilmington, Del., which it will be glad to distribute without cost to any contractors or engineers interested in the use of explosives for reducing the cost of engineering work.

CENTRIFUGALLY CAST IRON PIPE

The National Cast Iron Pipe Co., Birmingham, Ala., will be pleased to quote prices and send literature to any contractors interested in sand cast and centrifugally cast iron water or gas pipe.

A CONCRETE MIXER WITH STATIONARY DRUM

The claims of the Raber & Lang Mfg. Co., Kendallville, Ind., for the "Bull-Dog" batch mixer with a stationary drum, are told in detail in its catalog No. 37, which may be secured free by readers of CONTRACTORS' AND ENGINEERS' MONTHLY.

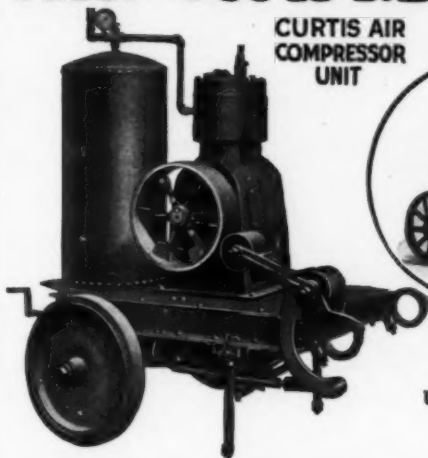
A ONE-TON DUMP BODY

The Jennings one-ton dump body for Ford trucks, built for gravity dumping and controlled by patented levers which enable the operator to dump the load from the side, is described in the literature of the Jennings Automatic Dump Body Co., 828 Third St., N. E., Roanoke, Va.

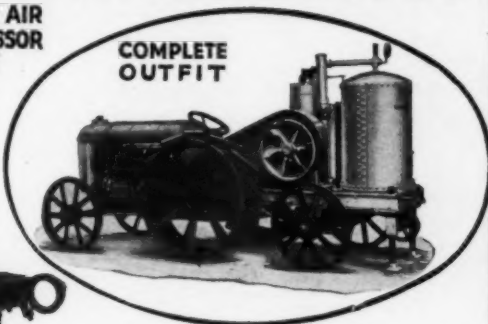
WOODEN BODIES FOR CONTRACTORS' TRUCKS

Wooden bodies with vestibule cabs, particularly adapted to general light haulage, are described in literature which may be secured from the Standard Commercial Body Corp., 423-431 E. 104th St., New York City.

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The flexibility of the Curtis Fordson Air Compressor Outfit is remarkable—Ideal for the road contractor, structural steel field jobs, oil field work, telephone construction, well drilling, etc. Just the thing to supply air for jack hammer drills, paving breakers, riveting hammers, rammers and tampers, compressed air hoists, sand blasts, stone cutting tools, quarry tools, rivet forgers, clay and coal mining diggers, for pumping water, for washing autos and trucks, unloading tank cars, paint spraying, caulking pipe lines, etc. For city streets can be equipped with rubber tires.

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When the Curtis Fordson is not being used as a compressed air outfit, the Fordson Tractor can be detached and used independently for hauling, loading, moving or power-driving purposes. The coupling is simple—nothing to get out of order or misfit. The whole arrangement is sturdy and practical—the Air Compressor Unit can be attached or detached by anyone in a few moments.

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HEAVY-DUTY CONSTRUCTION EQUIPMENT

The Koechring Co., Milwaukee, Wis., has issued a pocket list of Koechring heavy-duty construction equipment consisting of pavers, trailers, construction mixers, light mixers, bar benders, bar cutters, gasoline cranes, draglines and shovels, which it will be pleased to send to any interested contractor.

REPAIR BLADES FOR GRADERS AND SCRAPERS

Economy repair blades for blade graders and scrapers which have worn considerably, are described in the catalog and price list of the Shunk Mfg. Co., Bucyrus, Ohio.

A PORTABLE WAGON LOADER

The loader attachment for the Fordson tractor, made by the Spears-Wells Machinery Co., Oakland, Calif., is a complete and independent unit, designed specially for handling sand, rock and gravel from stock piles. This unit, which can be quickly detached from the tractor, leaving the latter available for other work, is described in detail in the literature of this company.

A FORDSON-MOUNTED WAGON-LOADER

The Specialty Fordson loader, which is made by the Specialty Engineering Co., Allegheny and Trenton Aves., Philadelphia, Pa., and which uses the Fordson tractor as its motive power and power-plant, is described in the illustrated literature of the Specialty Engineering Co.

EXTENSION FRAMES FOR ONE-TON TRUCKS

Extension frames which make it possible to mount longer bodies than can be taken by the ordinary Ford chassis, are made by the Swedish Crucible Steel Co., Detroit, Mich., and are described in its literature.

AUTOMATIC STEEL DUMP BODIES

The Superior automatic dump body for mounting on Ford 1-ton trucks, which dumps itself as soon as the latch is thrown, and returns to its original position after the load is dumped, is described in the literature of the Superior Boiler Works, Marion, Ind.

ROAD OILS THAT BOND

Complete information regarding the proper way to use road oils and the specific value of Texaco road oil, may be secured by writing to the Asphalt Sales Dept., The Texas Co., 17 Battery Pl., New York City.

BOTTOMLESS POWER DRAG SCRAPERS

Green bottomless power drag scrapers for excavating, digging and conveying with power instead of labor, are described in literature which may be secured from L. P. Green, 1234 Monadnock Block, Chicago, Ill.

A TRACTION DITCHING MACHINE

A light-weight traction ditching machine mounted on a Fordson tractor is made by the Chas. T. Topping Machinery Co., Box 242, Dayton, Ohio. This machine, which is adapted for excavating ditches, for pipelines, road construction, farm drainage, small sewers and irrigation, is described in interesting illustrated literature.

HAUL HEAVY LOADS WITH TRACTORS

A trailer truck mounted on two wheels and flexibly attached to the rear of a Fordson tractor is described in the literature of the Trail-Ford Corp., Ann Arbor, Mich.

FLAT-BODY SEMI-TRAILERS FOR HEAVY HAULING

Flat-body semi-trailers for use with the Fordson tractor have been developed by the Trailmobile Co., 31st and Robertson Aves., Cincinnati, Ohio. These outfits, which are two-wheel trailers, specially designed so that the tractor carries a proportion of the load, are described in literature which may be secured free on request.

A LIGHT GRADER FOR FINISHING WORK

Contractors will be interested in the one-man grader developed by the Wehr Co., 533-545 Thirtieth St., Milwaukee, Wis., utilizing the Fordson tractor as the power unit. The machine, which is described in illustrated literature, is heavily constructed and carries a 6-foot blade.

CONVERTIBLE LEVEL AND TRANSIT

A new Model 40 Sterling convertible level and transit for builders is described in the literature of the Warren-Knight Co., 136 N. 12th St., Philadelphia, Pa. It has a 13 1/4-inch telescope and can be converted from a level to a transit, or vice versa, in 10 seconds.

A SIDE-DUMP TRAILER

All-steel 3-cubic yard side-dump bodies mounted on rugged trailer units with a wheel-base of 96 inches, solid tires and solid wheels with Timken roller bearings and a turning radius of 16 feet, are described in literature of Whitehead & Kales Co., Detroit, Mich.

MANGANESE STEEL CASTINGS FOR CONTRACTORS

Catalog No. 3 issued by the American Manganese Steel Co., Chicago Heights, Ill., contains information regarding the use of manganese steel castings by contractors interested in dredging, excavating, and sewer works and shows how manganese steel wearing parts are particularly adaptable for excavating and dredging machinery, power shovels, trench machines, back-fillers and road machinery of various kinds.

BOTTOM AND END DUMP TRAILERS

A trailer of either the bottom or end dumping type, having special features of interest to contractors, is described in literature which may be secured from the Troy Trailer & Wagon Co., Troy, Ohio.

A POSITIVE-TYPE GROUT MIXER

A positive-type grout mixer and ejector which has a capacity of 500 bags of aggregate per 8 hours, is described in the literature of the Union Iron Works, Inc., Hoboken, N. J.

STEEL STORAGE BINS

Portable steel storage bins of the telescope type, permitting them to be lowered when ready to be moved, and raised when they are to be set up, to deliver crushed stone to trucks, are described in the literature of the United Iron Works, Kansas City, Mo.

A CHIP AND SAND SPREADER

A new machine which quickly spreads chips and sand for a blotter coat on oil surfaces and which has a capacity of 3 tons level full, or enough to cover from 500 to 1,000 feet of roadway, is described in the literature of the Universal Road Machinery Co., Kingston, N. Y.

AN ASPHALTIC REPAIR MATERIAL

An asphaltic material which has wide application in the construction and repair of asphaltic concrete roads and other asphalt work, has been placed on the market under the name "Ak-wa-falt," by the United States Asphalt Refining Co., 90 West St., New York City. This material, which is described in the free literature of this company, is composed of water and asphalt with a filler, and is applied cold for all purposes where used.

A FIRE-PROOF PARTITION TILE

Pyrobar partition tile, a gypsum product, admirable for fire-proof construction, is described in the literature of the United States Gypsum Co., 205 W. Monroe St., Chicago, Ill.

A CRAWLER TREAD FOR THE FORDSON

The Johnson Trackpull for Fordson tractors, with which the tractor is able to turn within its own length with no loss of power, is described in literature which may be secured from the A. C. Johnson Products Co., Racine, Wis.

RAILROAD AND HIGHWAY DECK DRAINS

A series of drains for use on railroad and highway bridges and other locations where waterproofing is necessary, is described in Catalog F of the Josam Mfg. Co., Michigan City, Ind.

A TRACTOR SCRAPE OUTFIT

A rotary scraper for use with a light-weight tractor, and particularly adaptable to work where material is to be dumped in a single pile or to be spread over an extended area, is manufactured by the Killifer Mfg. Co., Box 170, Huntington Park, Los Angeles, Calif., and is described in its literature.

POWER UNITS FOR CONTRACTORS' EQUIPMENT

Complete information regarding Le Roi gasoline engines, a dependable unit for contractors' equipment, may be secured from W. E. Karll, Sales Mgr., the Le Roi Company, Milwaukee, Wis.

LIGHT-WEIGHT LOADING EQUIPMENT

A dirt and gravel loader and auto dump scraper for mounting at the front of Fordson tractors has been developed by the Lessman Loader Mfg. Co., Box 1593, Des Moines, Iowa, and is described in literature which contractors may secure free on request.

AN ALL-PURPOSE DUMP BODY

The Lee-4-D all-purpose steel dump body, having a capacity of 1 cubic yard when level full and 2 cubic yards crowned, is described in the illustrated literature of the Lee Trailer & Body Co., 2343 S. La Salle Street, Chicago, Ill.

TYPES OF WIRE ROPE

Interesting and helpful information regarding the construction and uses of wire rope in all kinds of contracting work may be secured from the MacWhie Co., Kenosha, Wis.

ACCELERATING CEMENT SETTINGS

Complete information about G-F 12 Cement Accelerator, which speeds the setting of cement and is a particularly handy product for use in cold weather, may be secured from the General Fireproofing Co., Youngstown, Ohio.

A UNIVERSAL ROAD MACHINE

A one-man grader with scarifier attachment, which may be quickly mounted on a standard Fordson tractor with suitable crawler traction, is manufactured by the Gilbert Mfg. Co., Aberdeen, S. Dak., and is described in its literature.

A ONE-MAN ROAD GRADER

A one-man grader which makes use of the power-plant of the Fordson tractor aided by H. P. rigid rail tracks on the tractor, is made by the Haddfield-Penfield Steel Co., Bucyrus, Ohio, and is described in its interesting illustrated literature.

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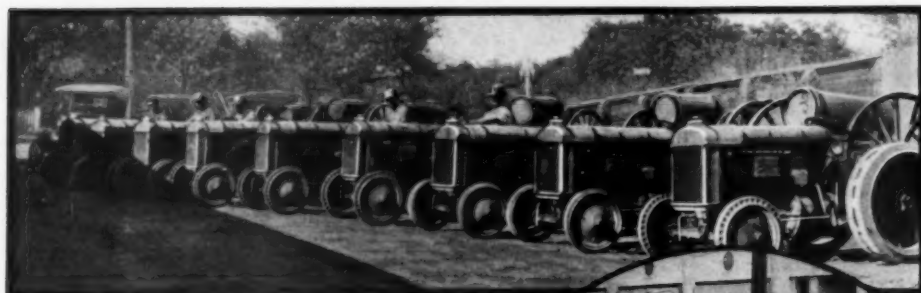
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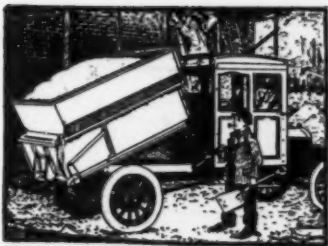
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can save you many thousands of dollars in the selection of the proper equipment.

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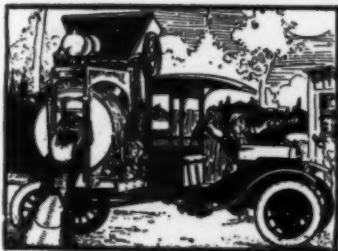
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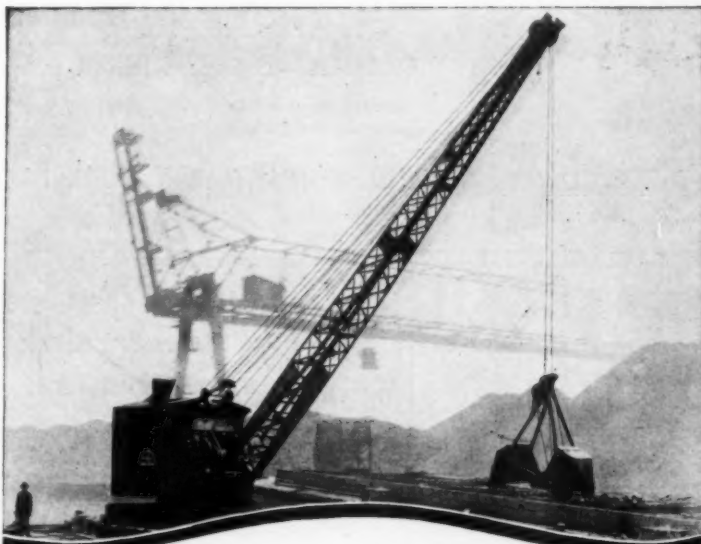
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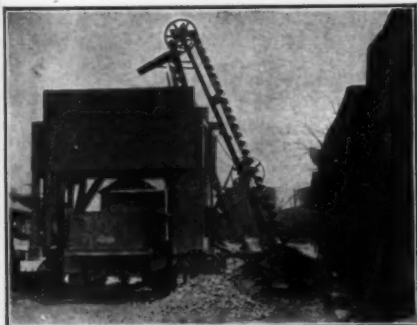
Mr. Brehm, Director of Public Works, City of Waltham, Mass., says: "Baker Plows did excellent work in our city and I know of no case where they were laid up at any time for repairs and if I were purchasing more, I would certainly buy Baker Plows."

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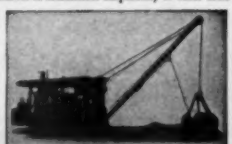
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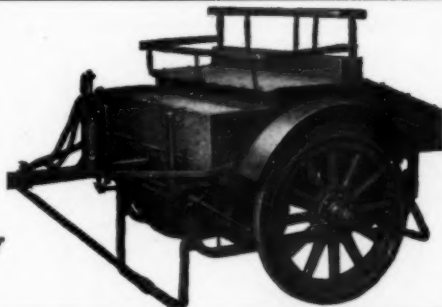
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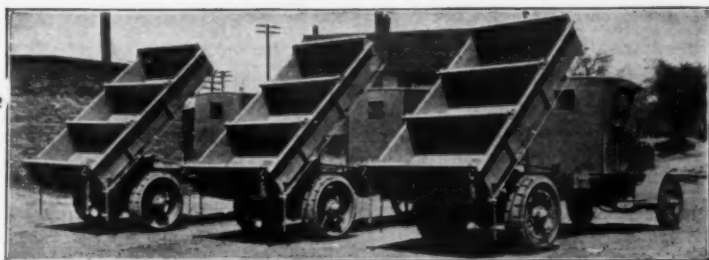
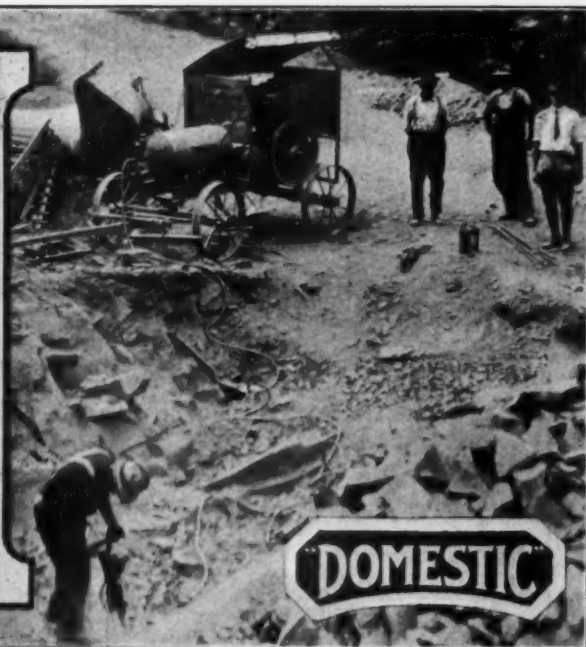
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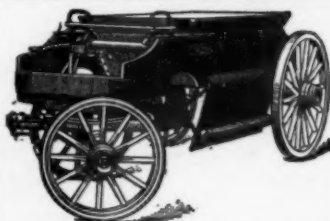
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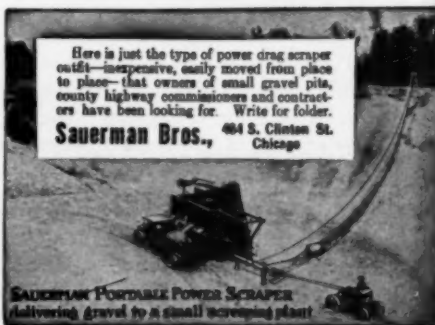
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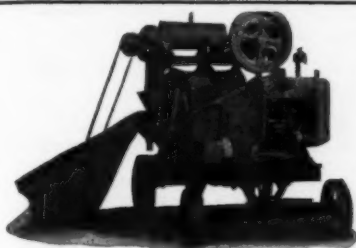
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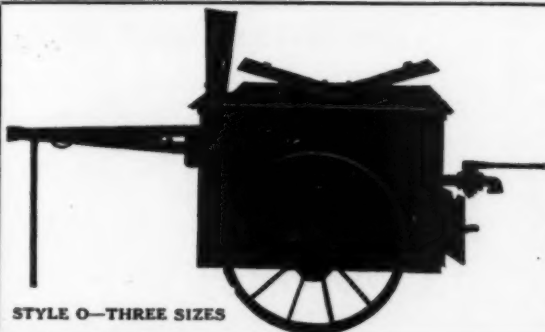
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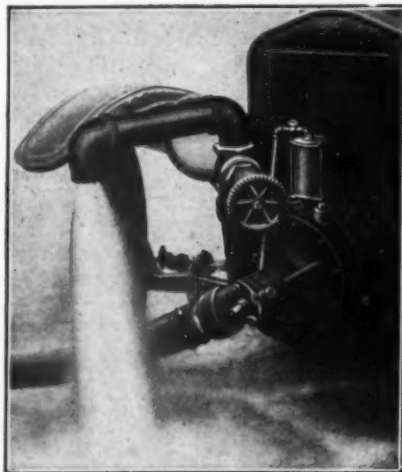
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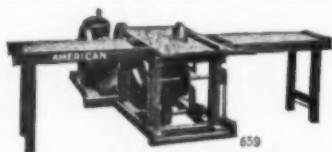
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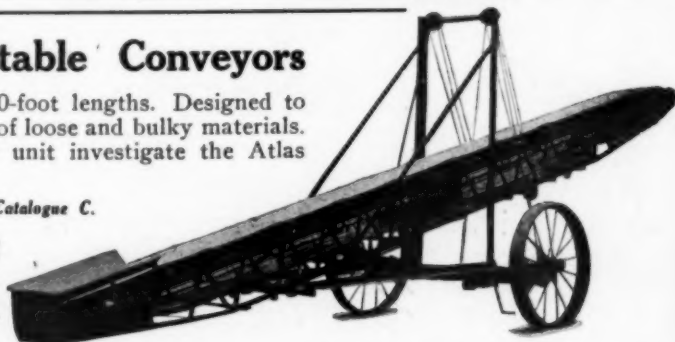
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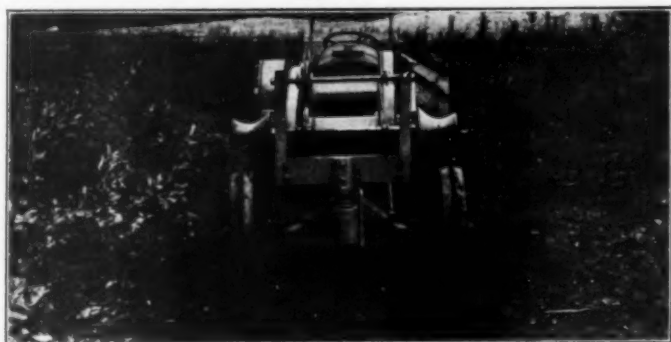
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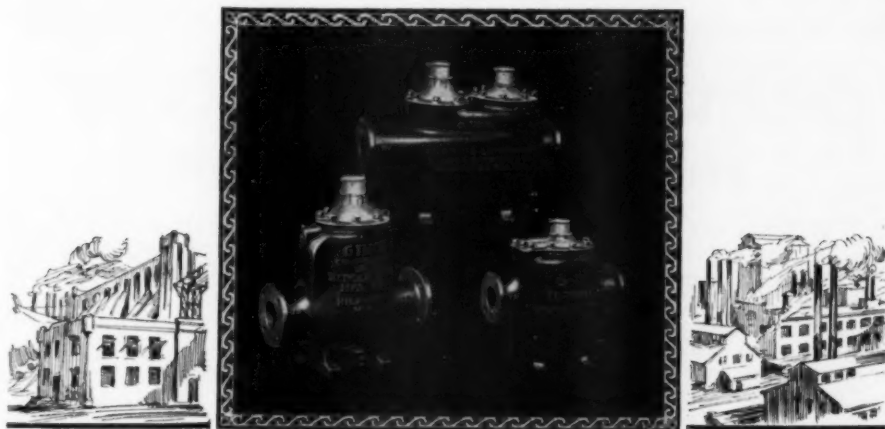
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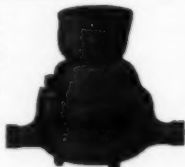
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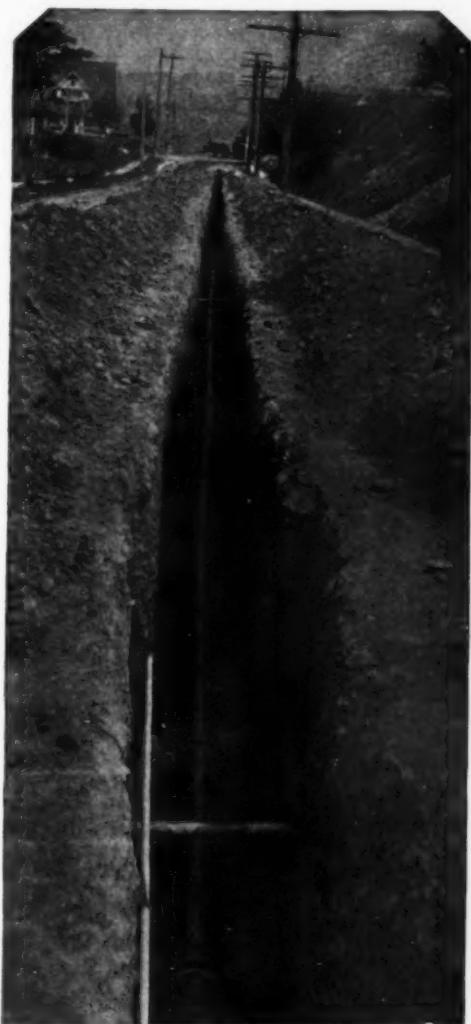
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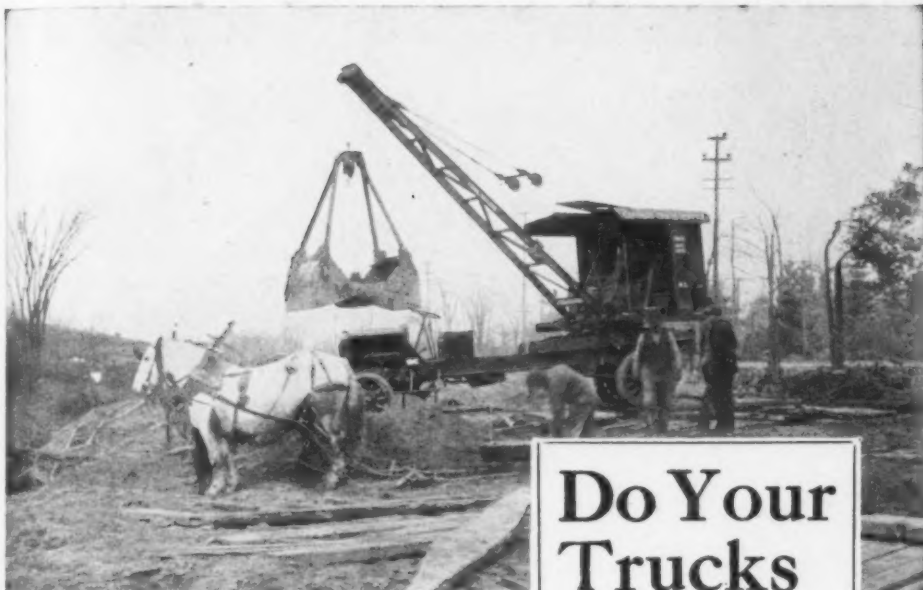
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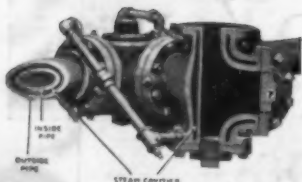
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